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BULLETIN

OF THE NEW YORK ACADEMY OF MEDICINE

Original Articles

by

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9. Fourth cervical nerve
10. Superior position of sternocleidomastoid muscle
11. Deep cervical lymph nodes
12. Fifth cervical nerve
13. Posterior supraclavicular nerve & anterior jugular vein
14. Superficial cervical artery & vein
15. Middle supraclavicular nerve & subclavian artery
16. Transverse scapular artery & vein
17. Inferior position of sternocleidomastoid muscle
18. External maxillary artery & anterior facial vein
19. Submaxillary lymph nodes & digastric muscle
20. Submaxillary gland & mylohyoid muscle
21. Submental lymph nodes & hypoglossal nerve
22. Superior laryngeal artery & nerve
23. Superior cervical ganglion
24. Superior laryngeal vein & omohyoid muscle
25. Superior thyroid artery & vein
26. Ansa hypoglossi
27. Common carotid artery & sternothyroid muscle
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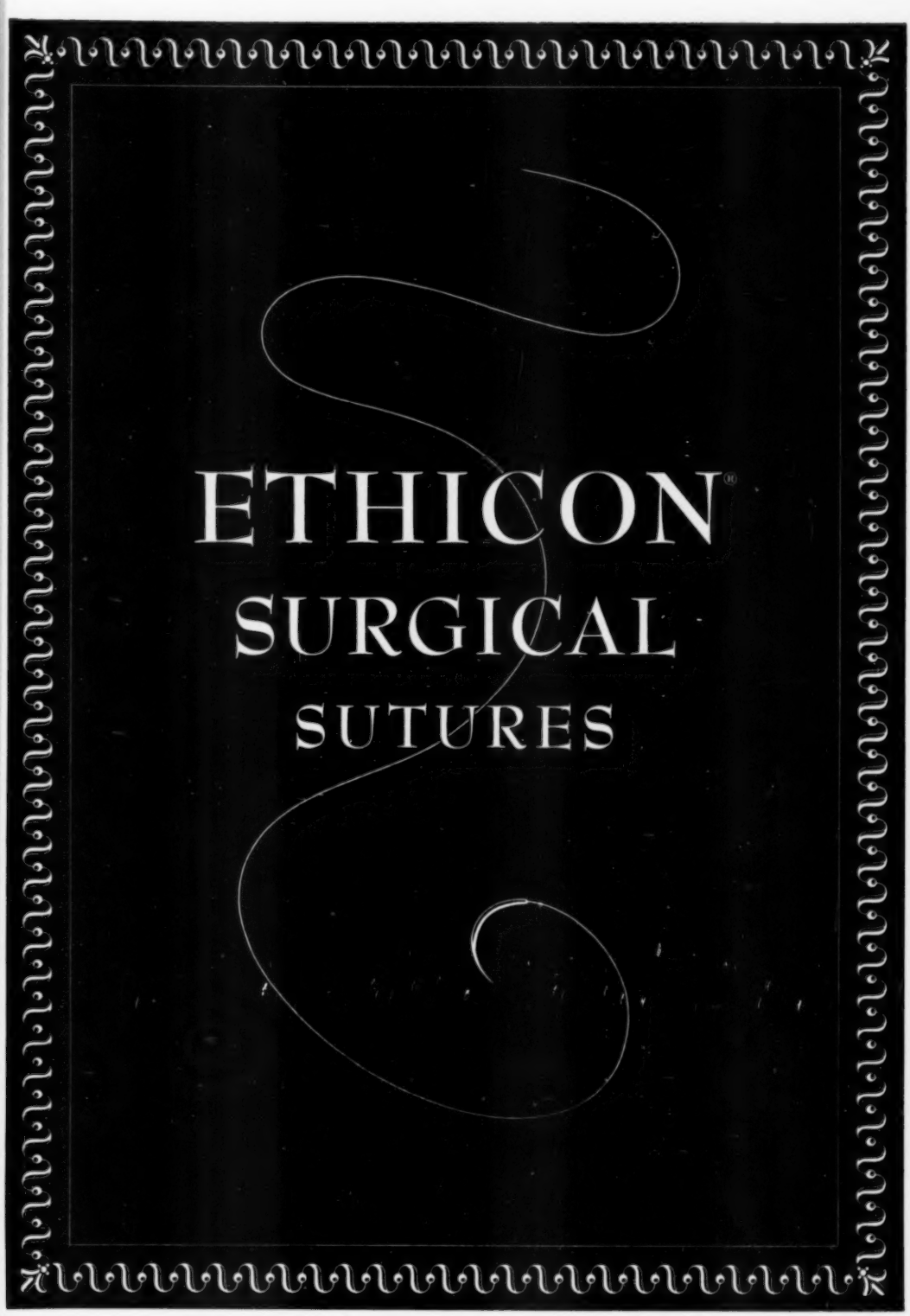
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AUTHORS ALONE ARE RESPONSIBLE FOR OPINIONS EXPRESSED IN THEIR CONTRIBUTIONS

ROBERT L. CRAIG, *Editor*

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BULLETIN OF
THE NEW YORK ACADEMY
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VOL. 29, NO. 4 APRIL 1953

ANNUAL MEETING ADDRESSES

INAUGURAL ADDRESS*

ALEXANDER T. MARTIN

President, The New York Academy of Medicine

FELLOWS of The New York Academy of Medicine, I accept the high honor which you have conferred on me. In the investiture of this office, I am deeply conscious of the responsibilities which it carries. My hope is, that I shall justify the confidence you have placed in me by electing me to be your President.

Dr. William Barclay Parsons, our retiring President, has set a high standard to follow, and I want to take this opportunity, in the name of the Academy, to extend to him our gratitude for his faithful and untiring services over the past two years. He has rendered a fine stewardship.

I like to think of the Presidency as a composite or a "fusion," representing the work and services of more than forty Presidents, who have preceded me in the last one hundred and five years. They have brought distinction to the functions of the Academy, and have given to it the high reputation it now enjoys universally in the City, State and Nation. We honor their memory to-night.

* Presented at the Annual Meeting of The New York Academy of Medicine, January 8, 1953.

To those Fellows who are active in the affairs of the Academy, and who shoulder the responsibilities and transact the duties of its many activities, the Academy is always grateful. They have, by their wisdom, their judgment, their enthusiasm and their loyalty, plowed into the soil the seed which by its fruition has resulted in that which we know as The New York Academy of Medicine.

I would be remiss if I did not mention the name of Dr. Howard Reid Craig, our Director. With the knowledge and assurance that he will be at the helm, my task and responsibilities will be less formidable. In the confidence that he will continue to direct and administrate the affairs of the Academy as effectively as in the past, the duties of this office will be greatly lightened. By his wise administration and efficient executive ability, he has maintained the high standards set by his predecessors. He has contributed greatly to bring the Academy to its high place of distinction. Special mention is made of three former Directors, the late Dr. Linsly R. Williams, our first Director, the late Dr. John A. Hartwell and Dr. Herbert B. Wilcox, who preceded Dr. Craig. These men brought significant contributions to the Academy, and added to its lustre and reputation.

The Trustees and our Treasurer have, by wise handling and husbanding of our financial resources, kept the Academy in financial equilibrium. In this our Director has played an important part. It is good to begin my term of office with the confidence that the Academy will be so well administered.

If I were to choose a text for this Inaugural address, I would capture the Latin inscription "*itinere uno pervenire, ad secretum tam grande non potest*" (it is not possible to arrive at a secret so profound by a single road). In a free interpretation of this aphorism, there is implied, that through its important Committees and its Council, there are many channels whereby ideas can be sifted and exchanged in free discussion, in the solution of the many and diverse problems which constantly arise, particularly in the areas of public health and education. These, the Council and the Five Standing Committees, represent a two way street, and are another example of the democratic process at work.

The Library constitutes our greatest asset. It is second in size only to the Surgeon General's Library in Washington, and is one of four or five of the most important medical libraries in the world. It contains some 275,000 bound volumes, and its circulation services are close to

100,000 items in one year. Great credit should be given to Dr. Archibald Malloch, our former Librarian, in bringing the Library to its present state of efficiency and distinction.

The Rare Book Room is another valued possession of the Academy. Here are stored priceless Incunabula and manuscripts of great historical importance.

In our changing world we should heed the Biblical injunction "can ye not discern the signs of the times?" Heeding this we should have an awareness of our present day world and adapt our thinking accordingly. Many of our habits of thought and many of our attitudes are no longer relevant. Over the years certain words in our language have changed their meaning. Even the Bible has been revised and a "sounding brass" has become a "noisy gong." All this adds to a confusion of ideas, and calls for clear thinking. New techniques and a revision of methods may be necessary. The Academy must be sensitive to these changes, and in this second half of the Twentieth Century, it should always be alert to discern these signs and trends. It is certain that in to-day's world we cannot carry on "business as usual."

There is a fork in the road in the Canadian north woods and at its bifurcation a sign which reads, "choose your rut now, you may be in it for the next two miles." We certainly must avoid this. Institutions like individuals have to make vital decisions in these uncertain days, which may determine their future.

One of the "signs of the times" may come from the sky itself. I refer to the influence of Television upon our modern life. Like atomic energy it can be made an instrument of incalculable benefit to mankind, or, if not well controlled and directed, be a plague o'both our houses. It has tremendous potentialities, and the whole program in medical education here at the Academy could undergo radical change. There are certain imponderables in the field of audio-visual education, which cannot now be guessed at, and the future cannot be foreseen. At the present time the Academy has under way a study and a survey of the use and influence of Television in the educational field. This is being carried out in cooperation and consultation with other educational institutions and medical schools. In the solution of many problems, we will need wise decisions. Let us hope that "out of this nettle, danger, we pluck this flower, safety."

In the guarding of the public health, the true physician must play a

double role. He must be a scientist and at the same time a humanist. This was aptly expressed by a former President of the Academy, the late Dr. William W. Herrick, who said, "without science the physician is a menace; without humanism he is no physician." The Academy, therefore, stands at the center of our professional life to strengthen and to undergird this dualistic role of the true physician, so that the quality of medical care will be maintained at the highest level. The public can then be assured, as long as the Academy stands, that the highest ethical standards will be maintained by those who make up its Fellowship, and that the continuing process of education is a guarantee against mediocrity. Our main educational resources are the Library, the Rare Book Room, the Academy Bulletin, the meetings of the Sections in the various specialties, the panels, the Graduate Fortnight, the lectures to the Laity, special Seminars and the Stated Meetings. A series of radio broadcasts to the profession is an important service rendered in the field of postgraduate education. All these facilities, except the Graduate Fortnight, are without fee and are attended by a host of physicians and students from around the world.

Another "sign of the times," which should be discerned, is in the field of Public Health. There are many controversial issues which demand clear thinking for an answer and solution. It is quite clear that the public is interested in and much concerned with the cost of illness, and how it can be met. To-day, the "hand-writing on the wall" is exemplified by the words "Doctor Bills," emblazoned in red letters in our subway cars, espousing a plan by one of our prominent banks, to insure against catastrophic illness.

This is but another example of health awareness, and indicates the concern and interest of the public. The maintenance of health, with its attendant cost, has made this another necessity of life, along with food, housing and clothing, and should be made a part of the budgetary plan for every individual. As doctors, we should be more than interested spectators, for in the last analysis we are the ones who render the service and who determine the quality of medical care.

Our profession has, from time to time, been told that in the matter of public health and its administration, we have been destructive in our criticism, rather than constructive.

The Academy had anticipated many of the issues raised, and in a voluminous report, entitled "Medicine and the Changing Order," gave

an answer and a plan of action for many of them. This report was the work of a distinguished Committee, made up of physicians, lawyers, clergy and prominent laymen with Dr. Malcolm Goodridge as Chairman. This Committee brought in its final conclusions and recommendations, after four years of meetings. It represents an important contribution in Public Health and Medical Education, and as a permanent record it marked the Centennial and the beginning of a new era for the Academy, the second one hundred years.

We enter this second half of the Twentieth Century with some misgiving and much uncertainty. We can say with St. Paul in his letter to the Church at Corinth, "for we know in part, and we prophesy in part." Further than this we cannot go.

In the Academy's plans for the future there is a great need for a publication fund for the financing of the publishing of books and manuscripts emanating from the Academy. A Committee has already been set up by the Director, and a very generous contribution has been made to initiate the fund. It is a desirable project and we hope a feasible one, and that it will be supported by the Fellowship.

In the re-reading of "The New York Academy of Medicine, its First Hundred Years," published a few years ago, I am impressed by the many distinguished names of individuals, who have served the Academy in one capacity or another, and who have made such distinguished contributions. This book, compiled and written by Dr. Philip Van Ingen, is a century mark in its history. I commend it for your reading. It was a prodigious task and represents a labor of love for which the Academy shall be forever grateful. In the reading of it, I am more mindful than ever of the high honor of this office.

In conclusion, I would like to submit these words, left us at the founding of the Academy in December 1846, at its first meeting place at 561 Broadway, "a local medical voluntary association, having for its objects the purification of the professional body." I would hope that this Inaugural Address, 106 years later, will have a similar purifying effect.

ADDRESS OF THE RETIRING PRESIDENT*

WM. BARCLAY PARSONS

LAST year in my annual report to the Fellowship of the Academy it was suggested that these reports are in the nature of an annual health examination, and that the criteria of health in respect to an institution are growth and productivity. It is with great satisfaction that I assure you that your Academy is in flourishing health and full of vigor, ready to continue with even greater zest in the coming year, the one hundred and sixth of its existence.

You have heard the various committee reports read by title and will have the opportunity of reading them at your leisure when the Annual Report is published. Certain activities of the past year are however sufficiently noteworthy to warrant your attention this evening. The one event that has affected most of the users of the building with some temporary inconvenience and will certainly be of the greatest good in the years to come has been the long awaited addition to the Library stack facilities, the alteration of the periodical room and the renovation with new lighting of the main reading room, the walls of which have not been cleaned, much less repainted, since this building was opened. Some unfortunate delays have been experienced but it is hoped that the work will be completed shortly. The users of the Library have been patient and cooperative during this period, but the staff has been not only patient but extraordinarily efficient in providing such excellent service under great handicaps.

The generosity of our Library has never been questioned and we have exchanged thousands of volumes with other medical libraries in this country for their duplicates needed here. In addition we were forced to clear out some ten tons of duplicates when the basement storage space was required for the new lower tiers of stacks. These books will be distributed to libraries abroad by the United States Book Exchange of the Library of Congress.

* Presented at the Annual Meeting of The New York Academy of Medicine, January 8, 1953.

A year ago it was announced that the Three Vesalian Essays by the late Dr. Samuel W. Lambert, Dr. Willy Wiegand and Mr. William M. Ivins, as well as the De Aneurysmatibus of Lancisi, translated by the late Dr. Wilmer C. Wright, were in press. It is a satisfaction to the Rare Book and History Department that they have been published. Other publications in the past year were an extended bibliography on Narcotic Addiction, quarterly listing of New Accessions, and a list of all the Academy's publications which are in print.

Friends of the Rare Book Room have completed five years of activity in which time the sum of over $15,000 that they have raised has made possible the purchase of many rare books and manuscripts, and the publication of the Academy Bookman. Moreover the Friends have donated many valuable items from their own collections. This organization which has done so much for the Library will welcome additions to their ranks.

The Committee on Medical Education, in addition to arranging the scientific programs of the Stated Meetings which in excellence were up to the usual high standard, instituted a new series of Monthly Panel Meetings on Therapeutics to replace the Friday Afternoon Lectures of former years. Attendance at these lectures had not been good. It is hoped that these panel discussions, of the type so popular at national meetings, will fill a need in postgraduate education for the practicing physician. A new venture, namely exploration of the possibilities and investigation of the advisability of using television for medical education is being undertaken by a subcommittee of the Committee on Medical Education. One ultra high frequency channel has been assigned to New York City for educational purposes. It is felt that the Academy is in an unique position to act as the center for such programs aimed at the practicing physicians, and that prompt action is needed to avoid the loss of this opportunity by default.

The Twenty-Fifth Graduate Fortnight was on the subject "Hormones in Health and Disease." The subcommittee and the Executive Secretary and his staff as usual did a magnificent job. A fascinating variety of interesting material was presented to nearly capacity audiences by a distinguished group of investigators, teachers, and clinicians in the evening lectures, panel discussions and clinics. The collected papers of the 1952 Fortnight are about ready for the press and should soon appear. The collected papers of the 1950 and 1951 Fortnights have been published this year.

The past year has as usual been a busy one for the Committee on Medical Information. In the ordinary routine some 13,000 inquiries were received and handled, about equally divided between the Press, the Profession, individuals and organizations; forty-one press releases were issued covering various activities of the Academy; and one hundred thirty-seven manuscripts, submitted by the leading publications in the United States, were reviewed by the Bureau and its consultants. Of the more outstanding activities of this Committee has been the organization and administration of the New York Academy's Postgraduate FM Program "For Doctors Only" to which has been added "Ten Minutes' Talks on Cancer" in cooperation with the New York Cancer Committee. This program is composed of transcribed talks given by Fellows of the Academy and others either delivered at the Academy or especially prepared for the purpose of FM broadcasting. A few moments ago I mentioned the concern felt by the Committee on Medical Education in regard to poor attendance at meetings and lectures and some steps taken to make postgraduate medical education easier to get and more interesting to the practicing physician. This FM program is parallel in direction. The reasons for poor attendance at meetings is not clear. Perhaps there are too many meetings, or too many journals, or that parking one's car is too difficult. At all events it is a matter of concern and these efforts are being made to bring education to the fireside. Much that is new is constantly appearing, and should be made available. If men will not try to get it one way, perhaps they may accept it in another.

The Lectures to the Laity were as usual well attended and have been applauded by the State Department, the Voice of America and the British *Lancet*. The Eastern States Health Education Conference and the Conference on Ministry and Medicine were again most successful.

Published by the Committee this year were the Transactions of the Conference on Morale and the Prevention and Control of Panic, the 1951 Transactions of the Eastern States Health Education Conference entitled "The Epidemiology of Health," and the 1952 Conference on Ministry and Medicine entitled "Moralisms and Morality."

The Committee on Public Health Relations has had a full and active year. During the summer the first phase of the study of Infant Mortality was published under the title "Infant and Maternal Care in New York City." This book is actually a self analysis by 104 hospitals having maternity services, out of a possible 107 in the city, using measurements

and standards provided by the Academy to enable hospital administrators to evaluate their own services. These hospitals cooperated by filling out questionnaires and by admitting the study teams from the Academy. The objective of the study was to correct the remaining deficiencies in a situation that has been improving steadily for many years. The second phase of the study dealing with preventable neonatal mortality is now in preparation for publication.

A study made by a committee of the American Academy of Pediatrics reporting the prevalence of accidental poisoning in children brought into sharp relief the fact that both the voluntary and municipal hospitals of this city are confronted yearly with a substantial number of accidental and other poisonings, and that New York City is without adequate facilities for identification of the great variety of poisons which may be introduced into the human body. Although the office of the Medical Examiner, as an act of courtesy, has cooperated splendidly on request, it has become obvious that there is an urgent need for a central toxicological laboratory. As far back as 1940 the Committee on Public Health Relations recommended the establishment of an Institute of Forensic Medicine, recognizing the vast opportunities for research and teaching available in the office of the Chief Medical Examiner but not being used because of lack of time, funds and facilities. At that time the Mayor was furnished with an outline for the organization and functions of such an Institute, complete with sketches and lists of equipment. This plan suggested a teaching institution as a cooperative venture between the Office of the Chief Medical Examiner and the New York University –Bellevue Medical Center, and included a toxicological laboratory. At last there is real hope that this will be accomplished, as the University has offered the City a site for the Institute and has informed the Committee that space in a building now under construction will be available as an interim laboratory for the diagnosis of poisoning.

A less happy outcome resulted from the efforts of the Committee to establish satisfactory high standards for the Chief of the Medical Division of the Board of Education having to do with the physical and mental health of the 40,000 teachers and employees of the school system in the City. The Committee was invited for the second time in ten years to establish proper qualifications for this extremely important position, and has not been alone in its efforts because the Civil Service Reform Association, the Public Education Association and the Women's City

Club, as well as other organizations, have been active in efforts to raise the standards in this important part of the school system. The Committee insisted that an internist should hold the position which should be full time with a few hours off each week for hospital affiliation to insure continuance of education. This last point has always been misconstrued by the Board as being part time service. The Board apparently accepted the Academy's recommendations but then provided for waiving of them. As no agreement was reached in further discussions, the Academy was constrained to issue a statement to the press reviewing its efforts over the past ten years.

A major undertaking of the Committee was to review that part of the Griffenhagen report for the Mayor's Committee on Management Survey dealing with the classification of medical and allied positions in the various city departments. A review of 108 proposed civil service titles gave the Committee an opportunity to enunciate principles applicable to municipal medical services and enabled it to point out the importance of such ancillary services as those of bacteriologists, chemists and nurses; to emphasize the need for adequate salaries to attract and retain competent medical examiners; and to indicate the desirability of maintaining the functions of the District Health Services at a high level.

With the completion of the last Academic year Dr. Corwin retired as Executive Secretary of the Committee on Public Health Relations after forty-one years of service. He was appointed when the Committee was established in 1911 and his has been the guiding hand and head ever since. The good repute that this Committee enjoys has been largely due to him and this the Committee recognized in a formal way by the testimonial dinner they gave in his honor last December at which his portrait was presented to the Academy and a large and distinguished company were present to do him honor. We are extremely fortunate in having as his successor Dr. Harry D. Kruse, who comes to us with great experience in this type of work and who has already by his energy and grasp of the problem given great promise for the future.

The Trustees and Council as hitherto have occupied themselves largely with the financial affairs of the Academy and also with matters referred by the committees for approval. This coming year the budget faces another deficit largely due to well deserved salary increases. As will appear in the financial report we are in a strong position due to a wise investment program. One action worthy of mention has been the

appointment by the Council of a committee to meet informally with a committee of the County Society to discuss matters of common interest.

If you will bear with me a few moments I would like to enter here a personal note to suggest to you what an enduring pleasure and satisfaction these past two years have given me. It has been such a privilege to have been associated with the committee members and the three executive secretaries, with Miss Doe and the Director, Dr. Howard Craig. He knows best of all what a hive of activity this Academy is because he is the one who runs it all, to whom all come for advice and help, who deals with lawyers, architects and cranks but who so wisely allows complete autonomy to the heads of each department. The President has the opportunity to see the work being done, and I can assure you that my admiration is boundless for all those who work here with such energy, enthusiasm and self sacrifice. I am deeply grateful for having had the privilege of acting as your presiding officer.

CITATION AND PRESENTATION OF THE ACADEMY MEDAL* TO RUFUS I. COLE, M.D.

WM. BARCLAY PARSONS

Retiring President, The New York Academy of Medicine

TWENTY-FOUR years ago Dr. Samuel McCullagh endowed the Academy Medal to be awarded for Distinguished Service in Medicine as often as the Council should see fit. Since then the Medal has been awarded but seven times, and always to individuals whose contribution made the award mandatory. Tonight the Medal is to be awarded to one whose service has indeed been distinguished in two ways, one of which has been most enduring, but the other although epoch making at the time is now outdated because of the speed of scientific discovery in this time in which we live.

In 1908 Dr. Rufus I. Cole was elected a Member of the Rockefeller Institute and at the same time was appointed Physician to and Director of the Hospital. It is not necessary to review the honors and positions of responsibility he has held since then, nor to review his bibliography of more than ninety papers with special reference to lobar pneumonia. It is pertinent to point out that although he was but thirty-six years of age when he was appointed Director of the Hospital he nevertheless envisioned its future with remarkable clarity and instituted for the first time the approach to clinical problems from the scientific point of view. The value of this intensive study of a few patients by scientific procedures at the bedside and in the laboratory has been proven beyond any doubt and led to the development of similar arrangements in a large number of institutions in this country and abroad. It is noteworthy that of 179 men appointed to the staff during his directorship,

* Presented at the Annual Meeting of The New York Academy of Medicine, January 8, 1953.

78 per cent went into full time academic medicine and thirty-six were selected for full professorship elsewhere. The influence of these men and therefore of Dr. Cole himself upon the teaching of medicine in universities and hospitals is obviously incalculable but certainly enduring.

The scientific investigations in which he was most interested were in relation to pneumococcal pneumonia. His anti-pneumococcal sera resulted in a marked reduction in mortality and this was a signal achievement, the value of which as an achievement is not dimmed by the fact that shortly afterward first chemotherapeutic and then anti-microbial agents have relegated it to a position of perhaps historical importance.

Dr. Rufus Cole, it is now my privilege to hand to you the Medal of The New York Academy of Medicine for your distinguished service to medicine.

CITATION AND PRESENTATION OF THE ACADEMY PLAQUE* TO MR. JOHN W. DAVIS

HOWARD REID CRAIG

Director, The New York Academy of Medicine

An institution such as The New York Academy of Medicine can achieve a position of trust and importance in the community only by reason of years of public service and a certain intellectual and moral solidity which characterizes the men who successively constitute its membership. But this position, of which we are so proud, has been the result of the interest, encouragement and contributions of many men and women both within and without the medical profession. Especially to these public-spirited lay individuals who have encouraged the activities of the Academy are we sincerely grateful.

With this thought in mind, the Council of the Academy, some two years ago, established an award in the form of a Plaque bearing the seal of the Academy, to be given for outstanding services to The New York Academy of Medicine whether by a physician or a layman. The committee having this matter in charge duly met and unanimously agreed on the recipient of this plaque who is our guest this evening, Mr. John W. Davis.

He is relatively a newcomer to New York, having arrived here in 1921, but, on the whole he has done very well since his arrival. He came to us from West Virginia by way of Lexington, Virginia, Washington, D. C., and London where he was United States Ambassador Extraordinary and Plenipotentiary. Returning to New York in 1921, he joined forces with Mr. Frank Polk, our then legal counsel, whose father had been Dean of the Cornell University Medical College and President of

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the Academy. In 1924, our guest tried to leave us for Washington, but the sidewalks of New York claimed its own, to our great good.

In 1943, Mr. Polk, to whom the Academy owed so much, passed away and our guest assumed the responsibilities of legal counsel to the Academy. But over these years he has been much more than a legal counsel. He has been a friend, a counsellor and an advisor to the Academy Council and to the Director. Our problems may have, at times, seemed trivial, but he has always been patient and understanding, giving unstintingly of his time and his experience.

In 1943 the Academy Committee on Medicine and the Changing Order under the chairmanship of Dr. Malcolm Goodridge, began its studies and its meetings. It met every Friday from 4:30 to 6:00 P.M. throughout the academic year for four years, published eleven concurrent studies and after almost another year published its final report, a landmark and a guidepost in assaying the position of medicine in our present social structure. Our guest of this evening was a member of the Committee, took an active part in its deliberations and served as a member of its final editorial committee. In many places this report bears the impress of his thinking and his verbiage. For his part in all this, the Academy is deeply grateful. Through his participation, the Academy came to know better the qualities of the man himself.

I am reminded that Judge Learned Hand wrote that Mr. Justice Brandeis "believed that there could be no true community save that built upon the personal acquaintance of each with each; by that alone could character and ability be rightly gauged; without that 'neighborly affection' which would result, no 'faith' could be nourished, 'charitable' or other. Only so could the latent richness which lurks in all of us come to flower." Of such has been our relationship with Mr. Davis.

May I read the inscription on the Plaque:

PRESENTED TO JOHN WILLIAM DAVIS
IN RECOGNITION OF OUTSTANDING SERVICE
TO THE NEW YORK ACADEMY OF MEDICINE

Mr. Davis, it is with gratitude, affection and great personal pleasure that I, on behalf of The New York Academy of Medicine, present this Plaque to you.

ADDRESS*

MR. JOHN W. DAVIS

Counsel, The New York Academy of Medicine

"I AM naturally bashful, nor hath conversation, age or travel been able to effront or harden me."

These words are not my own. They are those of Sir Thomas Browne, Knight, M.D., famed as the author of "Religio Medici" and also of the "Enquiries into Vulgar and Common Errors" which preceded Ripley's "Believe It or Not" by some 300 years. Nevertheless, if I may accept the verb "effront" as springing from the same root as the noun "effrontery," I wish to adopt the words of Sir Thomas as fairly descriptive of myself.

Without more saying you will understand what a trial it is to a bashful man to stand before this distinguished audience and receive a testimonial for virtues he never believed himself to possess and for services he cannot claim to have rendered. Yet, as Dr. Johnson remarked, when asked whether he had replied to a handsome compliment paid him by the King, "No, sir, when the King had said it, it was to be so. It was not for me to bandy civilities with my Sovereign." So I bandy no civilities with the Academy of Medicine or any of its learned members. Whatever it or they have said must be so. I tender them my humble thanks for the undeserved honor that you do me.

The layman's habit of accepting at par whatever emanates from the medical profession is traditional. This results not only from trial and experience but the more profound the layman's ignorance the deeper, perforce, must be his trust. True, the outgivings from medical sources are not always uniform or consistent. In this respect they are quite unlike those of the profession to which I have the honor to belong. Lawyers and judges never—hardly ever—disagree. That is well known. Nor are they hurried along as you doctors are by a constant search for some new thing.

I have thought no little of the similarities as well as the contrasts between your great profession and that of the law. You relieve pain

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and anxiety; sometimes so do we, even though in the process we must transfer anxiety from the shoulders of a client to those of another where it more rightfully belongs. You begin with an examination and a diagnosis, so do we. Occasionally your diagnosis fails to hit the mark, so does ours. You are wary of prognosis. To our sorrow and the sorrow of the client we are not always cautious in that respect. You have your heroes, Hippocrates, Galen, Vesalius, Harvey, Hunter, Pasteur, Lister, Reed—the list is unending. We, too, have our Pantheon, Trebonian of the Institutes, Cicero and Hortensius of the Roman bar, Malesherbes, the defender of Louis XVI, Coke and Mansfield of England, John Marshall of America, to name but a few. From the lives of such mighty dead we draw, alike, pride in our past and inspiration for our future.

But in the end you confront, many times alone and unaided, an adversary far more formidable than any of ours. Our guide is man-made law with all its changeability and our battles are fought in the wind-swept arena of human opinion. You face the inexorable laws of Nature often in their sternest and most terrible form. The constancy and courage with which you carry on the strife entitles you to the homage of your sister calling and of all men besides.

It is nothing short of startling to observe how far the practice of medicine has advanced within the scope of a single life. I think, not without reverence, of a certain country doctor, the best of his time and place. That he did what he could with the tools at his command, I do not doubt. But with what tools? Was diphtheria in town? Each night at bedtime the children of the house were lined up in rank and forced to swallow a spoonful of chlorine water as a preventive. Did an epidemic of measles break out? Then a bag of asafetida was hung around one's neck as an amulet, but whether to ward off the infection itself or to repel the personal approach of one infected, one did not know. Typhoid fever was almost a routine ailment in a town served entirely by dug water wells; and like pneumonia, you either survived the crisis of the fever and recovered or you did not. In the latter case the undertaker had a job, morticians being still unknown. Inflammation of the bowels, not yet promoted to the scientific status of appendicitis, was treated by ice bags over the affected area and perhaps a shot or two of morphine to deaden the pain. Again, the patient either recovered or else. Diabetics succumbed to the speedy ravages of the disease or by preference to the slower death by starvation. Smallpox claimed its occa-

sional victim and public opinion crowned with laurel those brave persons who dared to attend to the disposal of the remains. Now and then there came an even more alarming rumor of Yellow Jack on its way from New Orleans up the Mississippi and Ohio valleys. Truly that was a world where the pestilence walked in darkness, a world of nameless terrors and uncertain fate.

But now how changed! Of these former ailments so familiar, many have disappeared entirely or are no longer to be dreaded. The x-ray has come to reveal the patient's most intimate secrets. The electro-cardiograph pictures the pulsations of his heart as of a mere machine. Blood-pressure gauges, metabolism tests, electron-microscopes and a host of other mechanical as well as chemical tools are at your service. And day by day the list of antibiotics lengthens in seeming return to the medieval theory that for each specific disease there is a specific remedy if one could only find it.

But let the difference between the old medicine and the new be what it may, I still pay affectionate tribute to the memory of the old country doctor who, without thought of comfort by day or rest by night, went up and down in his community, using all the strength and knowledge at his command to relieve the suffering and, if it might be, to bring cure to his neighbors and his friends. He made no pretense of sainthood but many saints have done less to deserve the name.

Circumstances have altered. But so long as medicine is the Healing Art, I cannot think the relation between doctor and patient will ever greatly change. Perhaps the modern doctor tells his patient more because he has more to tell. Perhaps the patient understands more of what he is told because he, too, has learned something. But once confidence between the two has been established—and confidence is the *sine qua non* of all professional service—the patient is still but putty in the doctor's hands.

It is somewhat presumptuous, I know, for a layman to say even this much about the past and the present of medicine; it would be far more venturesome for him to predict its future. Each new advance in knowledge leads only to the borders of a still undiscovered country. Who can tell how vast are the confines of these regions still unknown? The geographers have mapped the entire surface of the earth; the astronomers have weighed and measured the stars in their courses; the chemist has sorted out the elements of which the universe is composed; but no one

yet has come to tell us the source and content of life or given us the means to forfend its inevitable end. These regions lie in your territory. Here there are areas still open to adventure, both of the mind and of the spirit. Here you are the true pioneers and frontiersmen. And may I say in passing that I trust the day may never come when the shackles of governmental control may slow your march or put barriers across your day-to-day advance. I no more believe in the socialized practice of medicine than I do in the socialized practice of law. I trust we shall never be plagued with either.

Pioneers and frontiersmen, I salute you. I tender you the gratitude of the countless multitude to whom you minister. And for your continued war against mankind's immemorial enemies, pain, disease and death, I give you courage as your weapon and freedom as your shield and buckler.

THE TWENTY-SIXTH ANNUAL GRADUATE FORTNIGHT

1953

DISORDERS OF THE BLOOD AND THE BLOOD-FORMING ORGANS

COMPLETE PROGRAM TO BE ANNOUNCED LATER

DISTURBANCES IN GROWTH*

LAWSON WILKINS

Associate Professor of Pediatrics, Johns Hopkins Medical School, Baltimore, Md.

THERE is a tendency to blame the glands of internal secretion for nearly every abnormality of obscure origin. The layman and uninformed physician apparently feel no hesitation in incriminating the pituitary when there is no obvious explanation for dwarfism. The discussion to follow will emphasize the difficulties of diagnosing pituitary dwarfism, particularly in a child before the age of adolescence.

GENETIC AND EXTRINSIC FACTORS INFLUENCING GROWTH

At the moment of fertilization there is laid down in the zygote a pattern of genes—or genotype—which represents a plan for the future growth, development and biologic constitution of the individual. These genetic factors may act directly upon the body cells or their enzyme systems, thereby influencing the growth and differentiation of the tissues. Hereditary differences in the genetic pattern or genetic mutations may account directly for variations in body build, for various congenital anomalies of growth and for certain types of dwarfism. In addition, genetic factors are responsible for constitutional differences in the endocrine pattern of individuals and, in turn, the endocrine glands may influence growth and development. The same may be said of constitutional differences in the nervous system which may exert its influence either directly upon the body or indirectly through the endocrine system. The effects of these *intrinsic regulators* of growth and development may be altered at any time in prenatal or postnatal life by *extrinsic or environmental influences* such as nutritional or vitamin deficiency, anoxemia or disease. Thus growth may be altered by 1) nutrition or disease, 2) genetic factors acting directly upon the body or causing

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constitutional differences in the endocrine pattern, 3) diseases of the endocrine glands or the hypothalamic centers. It is of special importance to distinguish true disease processes of the endocrine system from mere constitutional differences or temporary imbalances.

Growth vs. Development

In studying dwarfism it is necessary to distinguish between simple growth and certain developmental processes responsible for remolding and reshaping the body through embryonic and postnatal life until full maturity is reached. Some of the developmental changes which can be evaluated clinically without too much difficulty are as follows:

1. *Skeletal Proportions:* The ratio of upper/lower skeletal segments, measured from the symphysis pubis, changes constantly from birth to ten to eleven years of age. Thus at birth the ratio is 1.7/1.0 and at eleven years 1/1. In some dwarfs the skeletal proportions mature commensurately with the age of the child; in others, notably the hypothyroid type, the maturation of the skeletal proportions may be retarded to as great a degree as the height.

2. *Maturation of Features:* In early childhood the features undergo rapid development, due largely to growth of the bridge of the nose. During adolescence there is further maturation with lengthening of the nose and jaw. There are no satisfactory measurements of these changes and one must depend upon clinical observation. The persistence of a very infantile type of naso-orbital configuration is characteristic of dwarfism due to congenital hypothyroidism in contrast to hypopituitarism, while adolescent maturation of features helps distinguish genetic types of dwarfism or that associated with ovarian agenesis from pituitary dwarfism.

3. *Osseous Development:* This is evaluated by studying the ossification of the cartilages of the epiphyses, carpus and tarsus and comparing these with the degree of ossification which is normal for the age and sex. The level of osseous development is referred to as the "bone age." Normal children may show a deviation of the bone age from the chronological age of two or three years plus or minus. Nevertheless the study of the osseous development affords one of the best objective means of measuring one of the developmental processes in contrast to simple linear growth.

4. *Dental Development:* Relatively little attention has been paid to

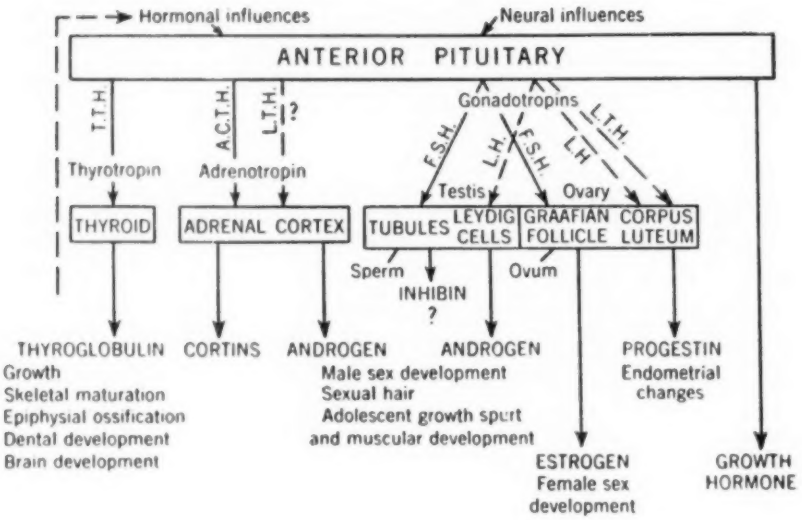

Fig. 1.—Endocrine Relationships Affecting Somatic and Sexual Growth and Development.

this. The time of calcification of the various tooth buds is probably a better index of dental development than the actual eruption of teeth, which may be impeded by failure of growth of the jaw. By comparison with standard tables of tooth formation, the "dental age" of a patient can be assigned similar to a bone age.

5. *Mental Development* can be determined by various psychometric tests and expressed as "mental age" or as I.Q.

6. *Sexual Development* is determined by the state of development of the various secondary sexual characteristics.

The simple evaluation of the levels of development in comparison to the height and age of a patient at a particular time may not be of great help in diagnosing the type of dwarfism. On the other hand, long term observation showing the rate of growth compared to the rate of osseous development or other maturation processes may reveal different patterns which may be of some help. These observations may be recorded on a simple chart in which height is expressed as "height age" to permit a comparison with "bone age" or "mental age." Other data concerning dental age or sexual development can be recorded on the same chart. We shall mention later some of the patterns seen in different types of dwarfs.

Endocrine Glands Influencing Somatic Growth and Development

Figure 1 shows the relationships of the endocrine glands concerned with growth and development. Somatic growth is influenced by at least three types of hormones:[1] 1) the *pituitary growth hormone*, 2) *thyroid hormone*, 3) *androgen* derived either from the adrenal or testis. All three of these have been shown to stimulate protein anabolism and increase nitrogen retention. Much remains to be learned about the details of their action both in accelerating growth and in bringing it to an end through fusion of the epiphyses. It is probable that each of these hormones manifests its effect at a somewhat different period of life and in a different way. Thyroid manifests its most important effects during the early years of life, although deficiency causes a cessation of growth at any period of childhood. Some writers think that thyroid accelerates growth merely by stimulating the secretion of pituitary growth hormone or that it serves as a catalyst for the pituitary hormone. However, in addition to its effects on linear growth it is responsible for many developmental changes—such as alteration in skeletal proportions, development of the features, ossification of cartilages and development of teeth and brain. The hypothyroid and hypopituitary dwarf are very different.

The fact that in both sexes there is a remarkable acceleration of growth and muscular development during adolescence is well recognized. Since it has been shown that these effects can be brought about by testosterone even when the pituitary is deficient, it is probable that the adolescent growth spurt, at least in males, is due to androgen. Estrogens have relatively little effect upon nitrogen retention and their administration does not cause much acceleration of growth in sexually immature females. It seems more likely that the adolescent growth spurt of females is also due to adrenal androgen rather than estrogen.

The period of life during which the pituitary growth hormone is elaborated and effective is not known. Some believe that it may be of relatively little importance during the first few years, as in hypopituitary dwarfs cessation of growth is often not observed until the third or fourth year. It is possible that its secretion is inhibited at the end of the growth period either by the action of the sex hormones upon the pituitary or because the pituitary shifts from somatotropic to gonadotropic activities.

TABLE I—CAUSES OF DWARFISM

I. *Bone Diseases*
- A. Chondrodystrophy—various types
- B. Rickets, all types
- C. Osteogenesis imperfecta
- D. Disease of the spine, such as tbc. caries

II. *Nutritional or Metabolic Disorders*
- A. Celiac disease and cystic fibrosis of pancreas
- B. Chronic renal disease
- C. Hepatic insufficiency
- D. Hurler's syndrome of gargoylism (dysostosis multiplex)
- E. Nutritional defects and chronic infections

III. *Circulatory Disorders with Anoxemia*
- A. Congenital malformations of the heart
- B. Extensive chronic pulmonary disease

IV. *Endocrine Disturbances*
- A. Hypothyroidism
- B. Sexual precocity with early epiphysial fusion
- C. Hypopituitarism
- D. Mixed types

V. *Delayed Adolescence with Retarded Growth Spurt*

VI. *Primordial or Genetic Dwarfism (Constitutional)*
- A. Familial
- B. Sporadic
- C. Syndrome of ovarian agenesis and dwarfism

VII. *Progeric Types of Dwarfism*
- A. Hutchinson-Gilford type
- B. Cockayne-Neill type

The ultimate height which an individual attains depends upon both the rate at which growth occurs and the length of time it continues. Cessation of the linear growth of the skeleton is determined finally by fusion of the epiphyses with the long bones. The cause of fusion is not entirely understood. The administration of estrogens hastens the process more than androgens. Although this may be a direct action of the sex hormones upon the epiphysial cartilage, it may be caused by their inhibition of the secretion of pituitary growth hormone. It has been shown that when rapid growth is induced in animals by growth hormone the epiphysial line is wide and that it becomes narrow when growth is diminished.

It is apparent from Figure 1 that an alteration in one of the hormones

affecting the body may be caused by a disorder arising in any of three centers of control: 1) the hypothalamus from which stimuli pass to the pituitary, 2) the anterior pituitary, or 3) one of the "target-glands"—the thyroid, adrenal or gonad. In determining the etiology of any endocrine syndrome due to a particular hormonal disturbance, it must be remembered that the primary disturbance may be in any of these three levels of control.

Causes of Dwarfism

In Table I are shown various groups of conditions which may lead to dwarfing. Before even considering a possible endocrine etiology the patient should be examined thoroughly to exclude various *bone disease* and *metabolic* and *circulatory* disturbances. X-rays reveal the various bone disturbances indicated. Among the systemic diseases the possibility of chronic renal insufficiency resulting from an obscure congenital urinary anomaly must always be considered, as stunted growth may result without evidences of so-called "renal rickets" or renal hyperparathyroidism.

Hypothyroidism: Among the endocrine disorders causing dwarfism, hypothyroidism is probably the commonest and also the most readily diagnosed.[2, 3] Hypothyroid dwarfism is characterized by the fact that there is not only stunting of growth but also marked delay in all the processes of maturation. When the deficiency has existed from an early age, infantile proportions of the upper and lower skeletal segments persist, the naso-orbital configuration is undeveloped, osseous development is retarded and dental and brain development delayed. If the deficiency does not develop until later childhood when a more mature skeletal development already has been attained, the characteristics of early infancy are not found. Marked retardation of osseous development is not in itself diagnostic of hypothyroidism and may be found in pituitary dwarfism or even in cases of delayed adolescence. Of greater significance than mere delay in ossification is the occurrence of punctate epiphysial dysgenesis.[3] It should be strongly emphasized that the diagnosis of hypothyroidism should not be based on the finding of retarded growth and development only, but that there must be physiologic and metabolic evidences of impaired thyroid function such as sluggishness, impaired peripheral circulation, poor muscle tone, constipation, hypercholesterolemia and diminished protein-bound iodine.

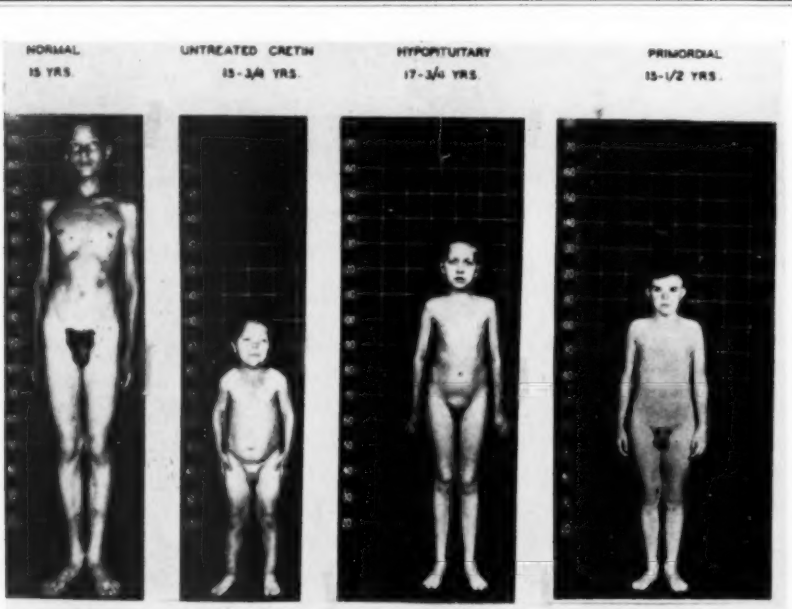

Fig. 2.—Male Dwarfs: Hypothyroid, Hypopituitary and Primordial Types.

Sexual precocity causes rapid growth and osseous development but eventually leads to stunted stature by bringing about epiphysial fusion before full adult height is attained. The condition is obvious on inspection of the patient.

When all the causes of stunted growth already discussed have been excluded there remains a large group of dwarfs who are difficult to classify during early childhood.[4] Unlike the hypothyroid dwarf, many of these have a ratio of upper to lower body segments which is not immature in respect to their age. There are many differences in body build which represent constitutional variations in habitus and have no special relation to the etiology of the dwarfism. Some of the patients are slender with small bones and thin, fine features; others are of stocky build with round, chubby faces. Some are born small and remain miniatures; in others the rate of growth may diminish more or less abruptly at some period of childhood.

During the preadolescent years one cannot predict with certainty which of the stunted children will mature sexually at approximately the average age, which will have a late but normal adolescence and which will remain sexually infantile. However, after the patients have reached adult years they may be divided into the following three groups:

Delayed Adolescent Growth and Development: A large portion of the stunted children brought to an endocrine clinic belong to this group. Often, but not invariably, they have been smaller than the average throughout childhood and have consistently shown a delay of two to four years in their epiphysial development. At the age when their contemporaries begin to mature sexually, grow more rapidly and broaden out, they remain sexually immature and continue to grow at a slow rate. The short height, lack of muscular development and psychic immaturity at this time make them more conspicuous and they are considered "little runts." Especially if the patient is a boy, the parents become more and more concerned and are led to believe that the child has a "glandular disorder." Eventually, but often not until the age of sixteen to seventeen years, puberty begins. Then there may be a rapid spurt of growth; or growth may continue comparatively slowly for a long period due to the fact that epiphysial ossification and fusion are delayed. There is frequently a family history of a similar pattern of growth. The condition may depend upon genetic influences affecting the general growth and maturation of the organism or there may be constitutional differences in the endocrine pattern of such an individual. However, the fact that these patients eventually mature sexually and usually attain average height shows that there is no specific defect of an endocrine gland but merely a delay in the activation of the pituitary-gonadal-adrenal system.

Pituitary Dwarfism: Dwarfs who remain sexually infantile probably have a pituitary defect involving not only the growth hormone but gonadotropic and other hormones. These patients may be of normal size at birth and grow normally during the first few years of life. After this, growth may become very slow but rarely ceases. There is usually considerable delay in the epiphysial development which may be just as marked as in hypothyroidism, but epiphysial dysgenesis does not occur. The skeletal proportions and the features do not remain as infantile as in hypothyroidism and there are not the characteristic slug-

gishness, circulatory impairment, elevation of cholesterol and other signs characteristic of hypothyroidism. Some pituitary dwarfs are subject to hypoglycemic attacks which are probably due to deficiency of adrenocorticotropic hormone and other hormones influencing carbohydrate metabolism. However, true Addisonian symptoms with evidence of failure of the electrolyte-regulating factors are not encountered. The sexual infantilism which occurs in the pituitary dwarfs is usually of a complete type. That is, there is absence of sexual hair in addition to lack of development of the other secondary sexual characteristics. In contrast, when hypogonadism is dependent upon a primary ovarian or testicular defect, sexual hair develops because the adrenals continue to elaborate androgen. In pituitary infantilism the impairment of the androgenic activity of the adrenal is shown by the fact that the 17-ketosteroid excretion is usually less than 2 mg. per day. Likewise, diminution of the gonadotropic activity can be demonstrated by the bioassay of urinary gonadotropins (the FSH test). Along with the failure of sexual maturation, the features of the pituitary dwarf fail to change to those of an adult. When the patient reaches the later twenties or thirties the skin may lose its elasticity and show aging while the features remain immature, causing an "oldish-young" appearance that is rather characteristic.

It is obvious from what has been said that the picture of panhypopituitary dwarfism unfolds gradually with advancing years. It is exceedingly difficult in childhood to prove the pituitary origin of dwarfism, except in the rare cases in which there are tumors or gross destructive lesions causing changes in the sella turcica or visual fields, or evidences of increased intracranial pressure. The occurrence of hypoglycemic attacks or failure to respond to hypoglycemia induced by insulin is suggestive. Until the patient is twenty years old there still may be doubt as to whether there is merely temporary delay in the gonadotropic activities of the pituitary or a permanent defect in the gland.

Primordial Dwarfism: This term has been applied to dwarfs in whom there is no retardation of developmental processes or other evidences of endocrine deficiency. Sometimes there is a familial history of dwarfing; in other cases it occurs sporadically. The patient is usually, but not always, small at birth and growth is slow from infancy. Epiphysial development and fusion occur at approximately the normal times. Sexual maturation takes place normally at about the usual time

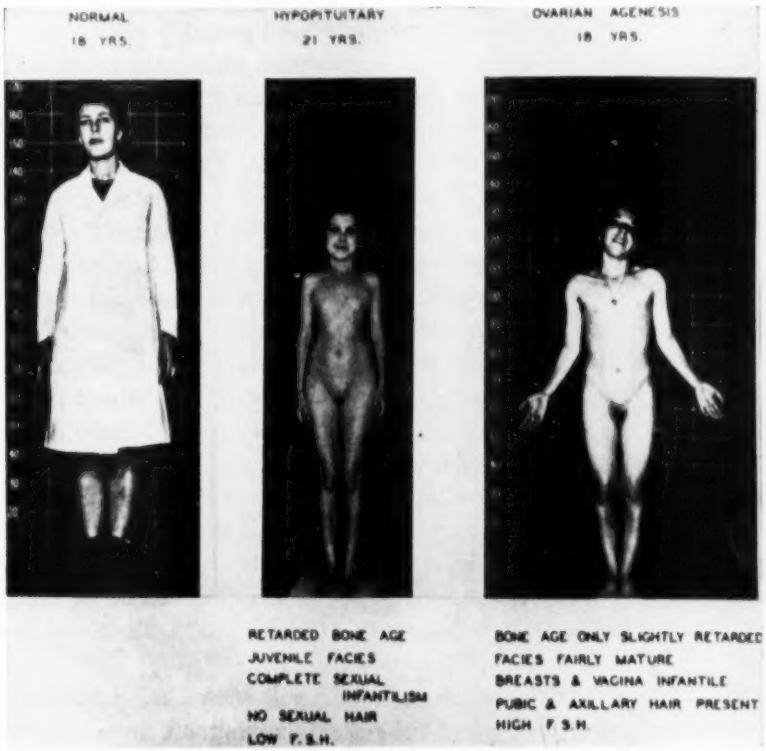

Fig. 3.—Female Dwarfs: Hypopituitary *vs.* Ovarian Agenesis.

and the features mature during adolescence. In other words, the child develops into a miniature adult. The condition could be explained on an endocrine basis only by assuming that there is an isolated lack of growth hormone without deficiency of other pituitary hormones. This possibility cannot be excluded; in fact, P. E. Smith has described a strain of dwarf mice in which the eosinophil cells of the pituitary are lacking. However, it seems equally plausible that the diminished capacity of the tissue for growth may depend upon an hereditary genetic variation or a genetic mutation, the effects of which are not mediated through an endocrine gland.

The Syndrome of Ovarian Agenesis and Stunted Growth: This is one of the most well-defined and clear-cut of the endocrine syndromes.

Although it was first recognized clinically in 1942,[5] cases are seen fairly frequently. The patients have a congenital and probably genetic defect causing lack of development of the ovaries which are represented merely as whitish ridges in the broad ligaments, composed only of ovarian stroma and containing no epithelial or germ cells. The patients usually attain a height of only 52 to 58 inches. That the dwarfing is not due to the ovarian deficiency is shown by the fact that castration of a prepuberal girl leads to excessive growth and eunuchoid proportions. The pattern of growth and development resembles that of the primordial, rather than the pituitary dwarf. That is, epiphysial ossification is only slightly, if at all, delayed and epiphysial fusions occur. The features mature as they ordinarily do during adolescence, in spite of the fact that the female sex organs remain infantile. These patients do not have the childish facies seen in hypopituitary dwarfs. Many of the patients look very much alike with rather mature features and poorly developed jaw and chin, so that one may frequently suspect the diagnosis from the appearance alone. Other congenital abnormalities, such as webbed neck, coarctation of the aorta, skeletal anomalies and eye muscle defects, are frequently present. The dwarfing can be explained best as a genetic defect which happens to be "linked" with the ovarian and other genetic defects.

In dwarfed girls who show congenital anomalies, particularly webbed neck or coarctation of the aorta, this syndrome should be suspected. After the age of puberty growth of pubic hair, together with absence of estrogenic manifestations such as development of the breasts, labia minora or vagina, suggests primary hypo-ovarianism rather than sexual infantilism due to pituitary deficiency.[6] The demonstration of a high titer of follicle-stimulating hormone in the urine confirms the diagnosis, but this is usually not found until after the age of twelve years.

Progeric Types of Dwarfism: Patients with the progeric type of dwarfism, described by Hutchinson and Gilford, are so bizarre and similar that the diagnosis is unmistakable.[7] The patients have peculiar birdlike features and bald heads. Senile changes and sometimes arteriosclerosis develop at an early age. There are usually mental defects. Cockayne[8] and Neill[9] have described somewhat different types of cachectic, progeric dwarfs with microcephaly, intracranial calcification and retinal atrophy. There is no evidence of a definite endocrine dis-

TABLE II—AIDS IN THE DIAGNOSIS OF DWARFISM

	Degree of Dwarfing	*Epiphysial Ossification & Fusion*	*Skeletal Proportions*	*Features*	*Sexual Development*	*Special Characteristics*
Hypothyroidism	+ + +	Marked retardation	Infantile	Infantile "cretinoid"	Late with incomplete maturation	Epiphysial Dysgenesis (stippling) High cholesterol, other signs
Delayed Adolescence	+	Moderate retardation	Normal	Immature	Retarded but eventually normal with late growth spurt	None
Pituitary Dwarfism	+ *to* + + +	Retardation	Normal	Immature	Remains infantile	F.S.H. low 17-K.S. low Prolonged hypoglycemia with insulin
Primordial Dwarfism	+ *to* + + +	Normal	Normal	Mature	Normal maturation	Otherwise normal
Ovarian Agenesis	+	Nearly normal	Normal boyish	Mature	Female organs infantile. Sexual hair present	F.S.H. high 17-K.S. low Osteoporosis Other genetic defects
Sexual Precocity	+	Premature	Short lower segment	Precocious Mature	Precocious	F.S.H. normal 17-K.S. high or normal. Rapid growth with premature ep. fusion
Progeria	+ + +	Normal	Mature	Old wizened	?	Slender emaciated bird-like features Arteriosclerosis Scleroderma (?)

order in these cases. It has been suggested that there may be some genetic defect leading to abiotrophic changes of various tissues or that an inborn error of metabolism may prevent the utilization of some cellular component.

Developmental Patterns as an Aid to Diagnosis during Childhood

We have pointed out the difficulty in the prepuberal years of distinguishing between delayed adolescence and growth, pituitary dwarfism and primordial dwarfism. Some of the diagnostic aids are summarized in Table II. We have felt that perhaps longitudinal studies over a period of years might reveal distinctive differences in the patterns when the rates of growth and osseous development were compared. In general there are four types of patterns:

1. The rate of osseous development is retarded to as great or even greater degree than the rate of growth. Most hypothyroid dwarfs and some pituitary dwarfs show this type.

2. The rate of osseous development is retarded less than the rate of growth but nevertheless the bone age falls progressively below the average. Many pituitary dwarfs show this type.

3. The osseous development remains consistently a number of years below the average, although it advances at a normal rate. We have frequently seen this pattern in stunted children who are late in the onset of adolescence but eventually mature normally.

4. The osseous development is within normal limits, although growth is markedly retarded. We see this pattern in primordial dwarfs who mature normally at the average time.

We do not wish to imply that there is an exact relationship between osseous development and sexual development or that a certain diagnosis of the type of dwarfism can be made merely on the basis of the developmental pattern. Nevertheless, we have found studies of this type of some help in prognostication.

Treatment of Dwarfism

The pituitary growth hormone which has been isolated in highly purified form is effective in rats but not in human beings. In fact, in humans it has been shown to cause nitrogen loss and other toxic effects. Whether this is due to contamination with small amounts of thyrotropic

hormone or is due to a species difference is not certain. Vitamin B_{12} has no effect in spite of the claims made for it. On the other hand, under proper conditions both thyroid and testosterone promote protein anabolism and accelerate growth and muscular development.

In hypothyroid dwarfs desiccated thyroid causes spectacular acceleration of growth but it has practically no effect in other types of dwarfism. In sexually immature dwarfs of other types testosterone, and sometimes chorionic gonadotropin, cause a rapid spurt of growth similar to that of adolescence.

Actually a large proportion of the stunted children brought to an endocrine clinic between nine and seventeen years of age are examples of delayed adolescence. If not treated they eventually mature sexually and may attain average height. There has been excessive enthusiasm for treating these patients and I rarely find it indicated in the cases which I see. Caution is wise until there is more exact knowledge concerning the effects of these hormones upon the endocrine balance and upon the development of the seminiferous tubules and interstitial cells. However, at times in boys the stunted growth and lack of sexual development lead to psychological difficulties so severe as to warrant treatment. An attempt may be made to accelerate testicular development by the administration of chorionic gonadotropin in doses of 1000-2000 units three times a week. It may also be advisable in some cases to supplement this with daily doses of 10-20 mg. methyl testosterone for several months. We would hesitate to give large doses of androgen over a long period of time unless it is proven that the patient is a case of true sexual infantilism. In girls, chorionic gonadotropin does not stimulate the ovary to produce estrogen and preparations of pregnant mare's serum which has an FSH effect are usually unsatisfactory or cause local reactions.

In boys over seventeen years when there is persistent dwarfism with sexual infantilism, treatment should be given. Although stimulation with chorionic gonadotropin would seem rational, it is expensive and frequently unsatisfactory, and in true pituitary deficiency one may expect its effects to disappear when it is discontinued. The oral administration of 25-30 mg. of methyl testosterone is the most convenient method of treatment. There is a rapid increase in growth with gain in weight and muscular development. Epiphysial development and fusion do not advance more rapidly than growth. The growth is most marked

during the first year and then slackens gradually until it is brought to an end by fusion. Usually the total increment of growth is only 5 to 7 inches. Although the psychological effects of treatment, the increased assurance, improved musculature and strength are of great benefit to the patient, it is doubtful whether the ultimate height attained is greater than might have been reached eventually without treatment.

In female pituitary dwarfs the administration of estrogens does not cause acceleration of growth and, in fact, may hasten epiphysial fusion. It is necessary to give androgen as well as estrogens. Doses of 10-20 mg. methyl testosterone given in addition to estrogen accelerate growth without causing virilization. Estrogens are given cyclically with monthly periods of withdrawal to permit endometrial breakdown and bleeding.

Efforts have been made to find a steroid which would have the protein-anabolic and growth-stimulating properties of androgen but would not be virilizing. This would be ideal for the treatment of children and women. Extravagant and unwarranted claims have been made for 17-methyl androstenediol. I am convinced, however, that if it is given in large enough doses to cause growth it will also cause virilization.

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MANAGEMENT OF ADDISON'S DISEASE IN ADRENALECTOMIZED PATIENTS*

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THE history of the treatment of Addison's disease presents a dramatic picture of the progression of our knowledge regarding some of the fundamental physiological alterations in electrolyte, water, carbohydrate and protein metabolism that accompanies this disease. The development of an adrenal cortical extract and synthetic desoxycorticosterone gave the addisonian patient a much better chance of survival, but still left him vulnerable to stresses which would produce adrenal insufficiency and frequently death. With the availability of the 11-oxygenated adrenal steroids, especially cortisone and hydrocortisone the addisonian patient was literally given a "new lease on life." While these compounds may not give complete replacement it has made the management of Addison's disease much easier.[1]

This paper will deal mainly with the management of the patient who is to undergo total bilateral adrenalectomy and briefly present some of the clinical and physiological observations we have made on the adrenal-less patient.

Experimental evidence in the animal has shown that adrenalectomy may either accelerate or retard the growth of certain types of cancers. In the human certain types of cancers are significantly influenced by alterations in the hormonal pattern of the body. This is clearly seen in cancers of the prostate and breast. The removal of testicular androgen will usually produce a marked regression of prostatic cancer.[2] There may be a relapse of the growth of the cancer after a period of remission induced by anti-androgenic control. The adrenal gland can produce both androgen and estrogen hormones. Could these sex-linked hormonal

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dependent cancers be activated by steroid hormones produced by the adrenal gland? Huggins and Bergenstal[3,4] have presented in previous publications the clinical and experimental evidence that led them to embark on a program of clinical and laboratory research to determine the role of the adrenal gland in the control of certain types of neoplastic growths.

Pre- and Postoperative Care of the Patient for Total Bilateral Adrenalectomy

The patient with advanced metastatic cancer who is to undergo adrenalectomy is frequently in a poor state of nutrition and we attempt to correct the lowered blood volume and plasma proteins by repeated blood transfusions before operation. A careful evaluation is made of the renal, pulmonary and cardiac status of the patient, for it is in these systems that the most serious postoperative complications are seen. We prefer ethylene-oxygen anesthesia and frequently use sodium pentothal for induction. With spinal anesthesia the patient has pain when the diaphragm is approached. The operation should be gentle and rapid and the entire procedure can usually be completed in ninety to one-hundred minutes. For us the posterolateral approach gives the best exposure; the head and foot of the operating table is lowered, flexing the body sharply. An incision 20–25 cm. long is made directly over the 12th rib, which is resected; care is taken not to enter the pleural cavity. The adrenal glands are friable and it is desirable to remove each gland intact and in one piece. The glands must be handled with the utmost gentleness. The adrenal is firmly held with a hemostatic forceps applied to fine but strong strands of adjacent adventitial tissue. Sharp dissection with scissors combined with a little blunt dissection is the best way to remove the gland. The only blood vessel that commonly needs ligation in the adrenal region is the adrenal vein. The right adrenalectomy having been completed, we turn the patient on the opposite side, redrape with sterile linen and proceed to remove the left adrenal as has just been described.

From the practical standpoint adrenal insufficiency must be forestalled. It is a safe rule in any proposed extirpation of the adrenal to treat the patient in advance as if adrenal insufficiency were certain to develop postoperatively and to withdraw the essential hormones slowly in the days after the operation. With the availability of cortisone acetate, bilateral adrenalectomy is no longer a perilous operation. We have

TABLE 1—SUBSTITUTION THERAPY FOR TOTAL ADRENALECTOMY

0 Minus 1 Day		
Cortisone acetate	50 mg.	6 a.m., 12 noon; 6 p.m., 12 midnight
Desoxycorticosterone acetate	5 mg.	6 a.m.
Sodium chloride	5 gm.	6 p.m.
0 Day (Day of Operation)		
Cortisone acetate	150 mg.	7 a.m.
Desoxycorticosterone acetate	5 mg.	7 a.m.
Operation		8 a.m.
Cortisone acetate		Every 4 hr.
0 Plus 1 Day		
Cortisone acetate	50 mg.	Every 6 hr.
Desoxycorticosterone acetate	5 mg.	1 injection
Sodium chloride	3 gm.	by mouth
0 Plus 2 Days		
Cortisone acetate	50 mg.	Every 12 hr.
Desoxycorticosterone acetate	0.3 mg.	As needed
Sodium chloride	3 gm.	
Subsequent Days		

The dosage of steroids is gradually reduced until the sustaining dose of cortisone acetate (25 to 50 mg. daily) is reached about one week after the operation; desoxycorticosterone is not required for maintenance therapy.

developed a program of hormonal substitution which has permitted us to do seventy bilateral adrenalectomies without postoperative adrenal insufficiency.

This substitution program is shown in Table 1. It essentially involves the use of rather large amounts of cortisone acetate the day preceding the operation and the operative day. On subsequent days the amount of cortisone is gradually reduced. Frequently the patient can be placed on oral cortisone acetate by the third or fourth postoperative day. The amount of DOCA given will depend upon how rapidly the blood pressure stabilizes at a satisfactory level. Frequently by the sixth postoperative day the patient will be on his future maintenance oral dose of cortisone acetate and sodium chloride.

During the operation approximately 500 ml. of normal saline is given during removal of the first gland; following this a unit of blood or plasma may be given, and should significant hemorrhage be encountered it is replaced by further blood transfusions. Following the operation 500 ml. of 5 per cent dextrose in normal saline and 1000 to 1500 ml. of 5 per cent dextrose in water are given slowly over the next

twelve to eighteen hours. Fluids by mouth are given as soon as tolerated.

At the termination of the operation an inlaying catheter is placed in the bladder to remain for two to three days. The adequate secretion of urine (20 to 30 ml. per hour) we feel gives us valuable evidence as to the status of the renal-vascular blood flow.

Antibiotics such as penicillin are used in the postoperative period. Acetylsalicylic acid, 0.6 gm., is given when the temperature is 38.5° C. or higher. Hypotension can frequently be corrected by use of a vasopressor substance such as norepinephrine in a concentration of 10 micrograms per ml. of saline and given intravenously at a rate which will give adequate blood pressure levels. We frequently use nasal oxygen in the postoperative period, especially if the patient has pulmonary metastasis or pleural fluid. They have a tendency to splint the thoracic cage since they have had surgical procedures in both costal areas. The patient becomes ambulatory in twenty-four to forty-eight hours after adrenalectomy.

Other types of hormonal substitution program for bilateral adrenalectomy have been described by West et al.[5] and Thorn et al.[6, 7]

Hormonal Maintenance of the Adrenal-Less Patient

Criteria for the adequate hormonal substitution of the adrenalectomized patient were the prevention of any sign or symptom of adrenal insufficiency. Probably the best indicator has been the sense of well-being of the patient. The patient becomes quickly aware of a sense of malaise, anorexia and loss of pep when on inadequate doses of cortisone. These symptoms are frequently seen before any changes in blood pressure, blood sugar or blood electrolytes are observed. They are usually quickly corrected by a small increase in cortisone dosage. We attempt to maintain the patient in normal electrolyte and carbohydrate balance and adequate blood pressure without orthostatic hypotension. We have used cortisone acetate orally in dose levels of 25, 37.5 and 50 mgm. daily. Patients are given added sodium chloride in dose levels of 1 to 3 grams a day. When maintained adequately, adrenalectomized patients have a healthy appearance, are not incapacitated and are able to engage in most of their usual activities. It has not been necessary to use DOCA for maintenance except in three patients who developed orthostatic hypotension. DOCA has been given to patients who we felt were adequately maintained on cortisone without any increase in sense of well-being or

increased ability to do work and no significant change was noted on withdrawal of the DOCA in these patients.

Prolonged fasts of eighteen to twenty-four hours have not produced hypoglycemia. The patients are able to stand the normal stresses of living. Many have had upper respiratory infections without evidence of adrenal insufficiency. One patient went to sleep in the sun and suffered a severe burn to the back; he did not change his dose of cortisone and the lesions healed uneventfully. We have seen relatively few cases (five) of severe adrenal crises and these only in patients with severe infections.

It would seem that in all but three of our patients cortisone acetate can give adequate hormonal substitution in the adrenalectomized patients. It still obviously does not represent complete replacement at a maintenance dose level since during periods of great stress adrenal insufficiency can develop. However, it is rare that a stress of such magnitude is encountered. Hollander et al.[8] have also stated that cortisone acetate alone seems to give adequate maintenance for the adrenalectomized patient.

Three of our patients developed marked weakness, malaise and dizziness when in the erect position. They were found to have rather marked orthostatic hypotension. This was not associated with significant alterations in blood electrolytes or blood sugar. In one patient whose systolic pressure lying was 110 mm/Hg and standing was 65 mm/Hg we attempted to correct this orthostatic hypotension by increasing the cortisone from 50 mgm. a day to 100 mgm. a day; this proved unsuccessful. We next increased the sodium chloride intake from 2 grams a day to 10 grams a day and this also did not correct the hypotension. We then gave him 2 mgm. DOCA intramuscularly daily and within forty-eight hours the orthostatic hypotension and symptoms disappeared. The other two cases of orthostatic hypotension were also rapidly corrected by daily administration of DOCA.

In Figure 1 is shown the blood pressure response of a patient (W.Z.) who has mild orthostatic hypotension when on cortisone acetate alone. This disappeared when DOCA was given. This patient had suffered a relapse of his cancer of the prostate and we wonder whether the cortisone acetate could be converted to some substance with androgenic activity and thus keep this cancer activated. The cortisone was withdrawn and DOCA substituted as shown in Figure 1. By the third day

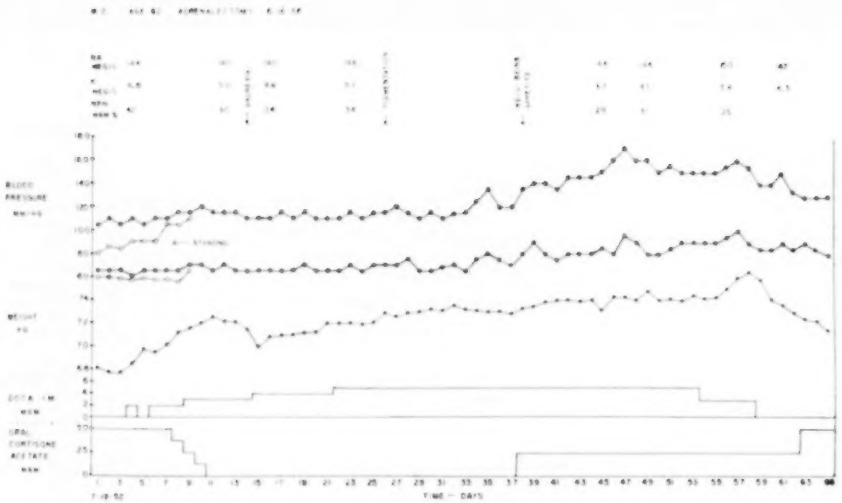

Figure 1

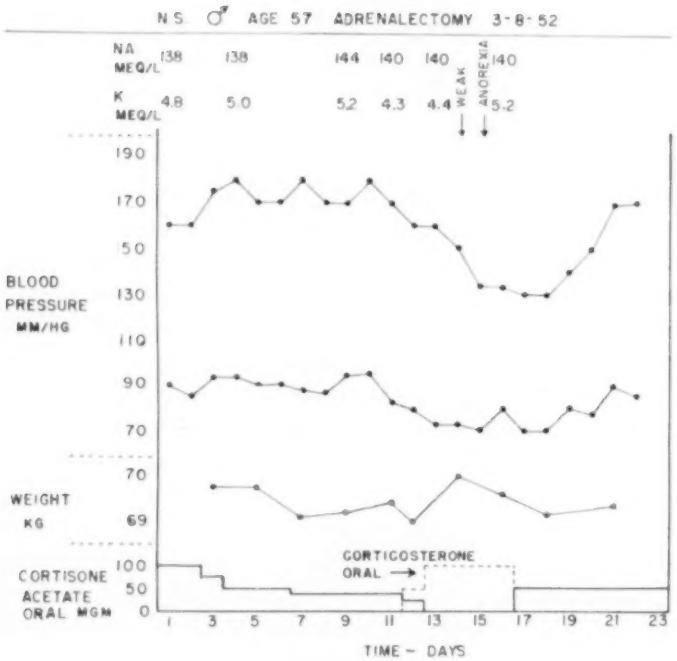

Figure 2

on DOCA alone the patient developed moderate anorexia and malaise which he continued to have until cortisone was reinstituted. Of great interest was the development of addisonian-like pigmentation in his operative scar on the thirteenth day of DOCA administration. Within twenty-four hours after cortisone was started his appetite returned and malaise disappeared.

We attempted to maintain one patient on corticosterone, Figure 2. The corticosterone was given in four divided doses daily. This patient had a mild hypertension and there was a significant drop in blood pressure during corticosterone administration. By the third day of corticosterone administration the patient complained of weakness, nausea, anorexia and malaise. Thus it would seem in this patient at the dose level given, corticosterone did not give adequate replacement.

Clinical and Physiological Observations on Adrenalectomized Patients

Treatment of adrenal crises: We feel that the successful treatment of a patient in adrenal crisis is dependent upon the use of large amounts of cortisone acetate. Cortisone acetate in divided doses totaling 300 to 600 mgm. intramuscularly has been frequently given during the first twenty-four hour period of therapy. Desoxycorticosterone acetate 5 to 10 mgm. is also given at once. The shock is controlled by blood or plasma and/or some vasopressor agent such as norepinephrine in a concentration of 10 micrograms per ml. of normal saline. One to three liters of 5 per cent dextrose in normal saline may be given daily depending upon the ability of the patient to take oral fluids. Since infection is so frequently the cause of adrenal crisis we usually give antibiotics such as penicillin and/or dihydrostreptomycin. In our experience, within twenty-four to thirty-six hours the patient is out of danger and the dosage of hormones may be reduced to maintenance levels within a few days. We have had no experience with intravenous cortisone or hydrocortisone, but it would seem that this method of administration might be effective more rapidly than with intramuscular cortisone acetate.

In our group of adrenalectomized patients fifteen have undergone a major surgical procedure such as ovariectomy, prostatectomy, cervical and lumbar spinal laminectomy. These surgical procedures were performed without development of adrenal insufficiency. The pre- and postoperative care was very similar to that for the adrenalectomy. How-

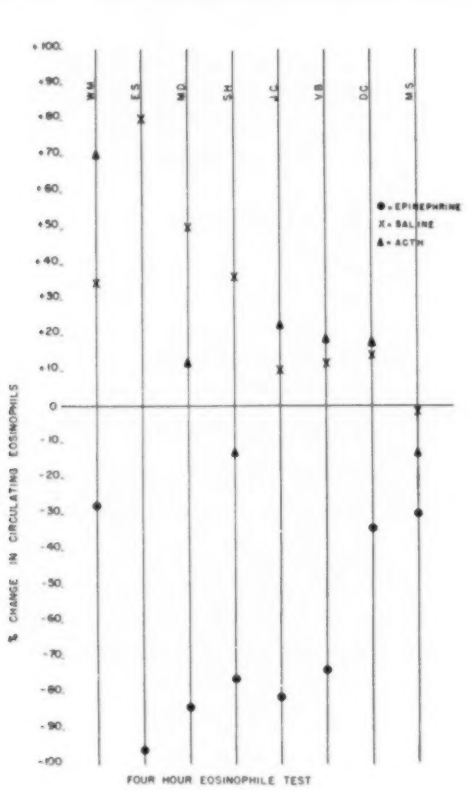

Figure 3

ever, only 100 mgm. of cortisone acetate were given the day before the operation and following operation the cortisone was more quickly reduced to maintenance levels so that by the third postoperative day the patient was frequently on his preoperative maintenance program.

Eosinophile response to ACTH and epinephrine: All patients given ACTH (25 or 50 mgm. I.M.) in the postoperative period have failed to show after four hours a significant decrease in the blood eosinophile level. G. Thorn et al.[3] have shown that epinephrine given to patients with Addison's disease in larger doses than that used in the standard four hour epinephrine test will in many cases produce a 50 per cent or more decrease in eosinophile count. A series of eight adrenalectom-

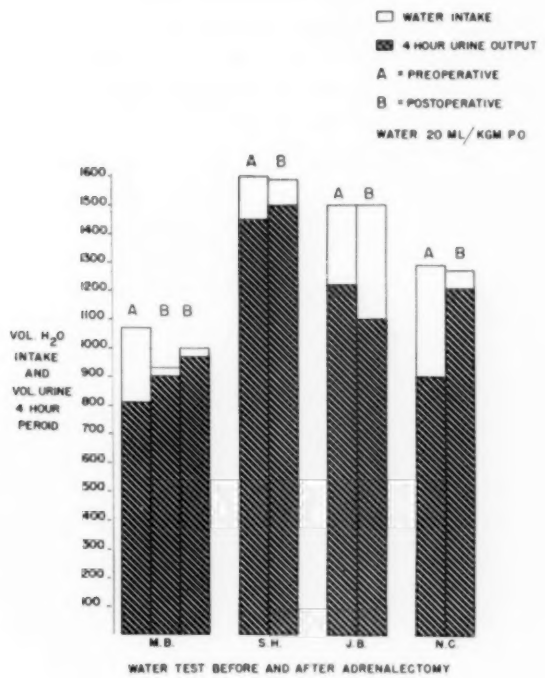

Figure 4

ized patients were given three four-hour eosinophile tests. There were two day intervals between the tests and the patients were fasted and given no cortisone the morning of the test. The drugs used in an attempt to alter the blood eosinophile levels were as follows: 1) Saline 0.3 ml. intramuscularly, 2) Epinephrine 0.3 ml. aqueous 1:1000, intramuscularly, 3) ACTH 25 mgm. intramuscularly. The results of these tests are shown in Figure 3. Thus in many of the adrenalectomized patients there is a significant lowering of the blood eosinophile level following the administration of epinephrine.

Eosinophile counts taken daily following adrenalectomy show some depression on the first two to four days postoperatively but then frequently stabilize at levels 25 to 200 per cent above the preoperative levels.

By use of the Robinson-Kepler-Power[10] water test it is possible to demonstrate a failure of adequate water diuresis in the patients with Addison's disease. A group of patients were given water loads before and after adrenalectomy. All the patients in this group were maintained on 50 mgm. oral cortisone acetate daily. As can be seen in Figure 4 there was observed no failure of adequate water diuresis after adrenalectomy while the patient is being maintained on cortisone.

In a series of fifty adrenalectomized patients there has been no incident of severe hypoglycemia. In patients on adequate hormonal maintenance with cortisone the oral glucose tolerance tests have been normal and the same in the pre- and postoperative periods. There have been no hypoglycemia episodes after intravenous glucose tolerance tests. Two patients with diabetes mellitus required the same insulin dosage after adrenalectomy while on a maintenance dose of 50 mgm. oral cortisone acetate daily.

Although nitrogen balance studies have not been done it is quite clear that at a maintenance level of 37.5 to 50 mgm. of cortisone daily the patients are able to synthesize and to increase the concentration of plasma proteins.

Many clinicians have observed a decrease in the pigmentation seen in Addison's disease when cortisone is administered. Huggins and Scott[11] in 1945 described the development of intense addisonian pigmentation in two patients in ten to twelve days following bilateral adrenalectomy at a time when only DOCA and adrenal cortical extract were available for replacement therapy. No addisonian type of pigmentation has been observed in a group of forty adrenalectomized cancer patients who have been maintained solely on cortisone acetate and sodium chloride. The longest period of observation has been sixteen months. One patient (J.F.) suffered a severe sunburn and the lesions healed without the development of pigmentation. A patient (W.Z.), Figure 1, showed no evidence of pigmentation for six weeks after adrenalectomy and when the cortisone was withdrawn and he was maintained solely on DOCA he developed pigmentation on the thirteenth day in his operative scar.

The electroencephalogram in five patients remained unchanged after adrenalectomy.

In three patients with metastatic carcinoma of the prostate we have observed the development of a hemorrhagic phenomenon characterized

by the development of ecchymoses which usually start on the lower extremities and progress upward over the abdomen and chest. This has usually occurred within three to fourteen days after bilateral adrenalectomy. One patient died of a cerebral hemorrhage and the other two patients survived but it required some weeks for the lesions to disappear. We were unable to obtain positive blood cultures and the routine hematological tests including fragility studies and platelet counts were normal. Recently Tagnon and Whitmore[12] and West et al.[5] have reported similar observations and have noted an increase in fibrinolysin titer in the blood.

The adrenal weight of glands removed surgically from patients was in the same range as values reported by others for the adrenals of normal persons as obtained at necropsy. Also the content of solids, electrolytes, lipoids, and ascorbic acid did not differ from values obtained on the adrenal of psychotic persons removed at operation by us. Admittedly there are only meager data concerning the status of normal adrenal glands of healthy human adults since this material is hard to secure. Disease per se, infection especially, is known to increase the adrenal weight. The best data for the weight of normal adrenal glands comes from cases of sudden accidental death. From data of this type it is gathered that a normal human adrenal of healthy adults weighs in the neighborhood of 4 - 4.5 grams.

The average weights of the adrenals of patients with cancer in this series fell within normal limits. All the neoplasms were in very advanced stages. The glands from persons with mammary and prostatic cancer had a higher percentage of water (less solids) than the patients without malignancy. The ascorbic acid content of the adrenals of both cancer and non-cancer patients was about 150 mgm. per 100 grams. Significantly decreased ascorbic acid value was found in only one of three patients with prostatic cancer treated some weeks with cortisone acetate.

Conclusions

Bilateral adrenalectomy can be carried out in man with little danger. A hormonal substitution program has been presented which in our series of patients has given adequate hormonal replacement. The adrenalectomized patient can in nearly all cases be satisfactorily maintained on oral cortisone acetate and sodium chloride. It is difficult with the

available clinical tests to show a significant difference in response after adrenalectomy when the patient is maintained on cortisone acetate. It is interesting that cortisone which is found in only small amounts in the perfusate of perfused adrenal glands can be so effective in hormonal maintenance.

Cortisone acetate, however, does not provide complete replacement at maintenance dose levels for during severe stress adrenal insufficiency can develop. We are still not able to anticipate the needs of the body for increased amounts of cortical adrenal steroids during periods of stress.

Thus we continue to search for the adrenal hormone or combination of hormones which may more closely represent the secretion of the normal adrenal gland and be able to administer these hormones in such a manner that stressful situations may be adequately controlled.

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THE DEVELOPMENT OF BRAIN TUMOR SURGERY*

The Charles A. Elsberg Lecture

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MR. PRESIDENT and Members of the New York Neurosurgical Society and Guests: You are aware, I am sure, that it is a signal honor for me to have been asked to give this lecture, and I deeply appreciate your kindness in having chosen me to be with you at this time. On my part, it is a great privilege in some small way to pay tribute to one of the pioneer figures in neurosurgery in this country. Dr. Charles A. Elsberg, whom we honor tonight, was, as you well know, one of an exceedingly small group of surgeons who in the very early days of their careers began to devote themselves almost entirely to operations upon the nervous system, and because of this concentration, were able to advance our knowledge of neurological diseases as well as perfect most of the operative measures which we have now come to regard as routine. Dr. Elsberg played no small part in many of these significant advances, but his name doubtless will be remembered particularly in connection with his operations and investigations on the spinal cord and its diseases as set forth in many articles as well as in his comprehensive monographs on this subject, published in 1916[1] 1925[2] and 1941.[3] These are memorable records of fine work and excellent analysis.

But in addition to his outstanding professional work, I think of Charles Elsberg as a quiet, kindly person, who always created a friendly atmosphere, and never failed to say an encouraging word or to offer constructive criticism when discussing someone's paper in a meeting.

It is my purpose tonight to review in some degree at least, the development of brain tumor surgery from its beginning in the latter part of the nineteenth century until the present time. As in the case of all modern surgery, the discovery of anesthesia in 1846 and of the antiseptic

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method by Lister in 1867, were essential to advances in operations upon the nervous system. However, for undertaking the removal of brain tumors a still further step was necessary, namely, the ability to localize these lesions within the intracranial cavity. It was therefore not until the experimental work of Fritsch and Hitzig on cerebral localization in 1870, and the clinical investigations on this subject by neurologists, especially in England and on the continent of Europe as well as in America, that any attempts at brain tumor surgery could be undertaken.

Macewen, of Scotland, was doubtless the first surgeon to remove a brain tumor successfully when he operated upon a growth involving the meninges in 1879.[4] This tumor had caused thickening of the bone in the left frontal region, but the patient had also had fits involving the right arm and face. The patient made an excellent recovery and lived for eight years. In May 1884 Durante, an Italian, removed what may have been a subfrontal meningioma, and this patient likewise made an excellent recovery.[5] In November 1884 Sir Rickman Godlee removed a glioma from a patient after the tumor had been accurately localized neurologically but the patient died some weeks later of meningitis.[6] This case has been referred to frequently as the first to have been so localized and removed, but Jefferson[7] has recently brought forward the fact that the tumor of Macewen's patient in 1879 had likewise been localized by the neurological evidence, namely, the focal seizures on the right side rather than by the bony thickening. Indeed, as Jefferson points out, Macewen in 1883 had also operated upon a second tumor patient, in this instance a gumma, before the Bennett-Godlee case. Without belaboring the point too far I would like to quote Jefferson briefly as to the Macewen operation in 1879 since he has clarified completely the situation regarding these earliest brain tumor operations and Macewen's priority in operating on neurological evidence. He says: "Now priority is only important if it marks the birth or the first application of an intellectual concept. Macewen made the essential point for himself, and I shall not tire of repeating it that he positively disregarded the external signs, and made his trephine opening where his knowledge of cerebral localization told him that the tumor would be. In that sense the concept can be definitely dated, and the priority is Macewen's by six years." At all events, these are four of the earliest examples of brain tumor operations, and along with them should be mentioned the successful removal of a cerebral meningioma by W. W. Keen in 1889.[8] This patient made

an excellent recovery and was in good health for many years as subsequently noted by Dr. Keen.

Perhaps the earliest attempt to collect reported cases of brain tumor operations was made by von Bergmann[9] in his monograph on cerebral surgery in 1889. At that time he recorded seven examples of apparently successful removals, but only three of the patients lived longer than three months after their operations. Von Bergmann did not have in this material the cases of Macewen and Durante. It is of interest that this great German surgeon even in these early days urged that those who would operate on the nervous system should learn neurology in order that they might treat their patients more intelligently.

Previous to von Bergmann, in 1886, Hale White[10] in England had studied a series of brain tumors seen at autopsy, and concluded that not over 10 per cent might have been operable. Knapp and Bradford[11] in this country came to about the same conclusion in 1889, also from a study of autopsy cases of which they collected 485. However, they were able to find twenty-three patients in the literature whose tumors had been localized neurologically and operated upon, and in fifteen of these the tumor had been found and removed. The so-called "removal," however, was seldom complete, as will be seen from further statistics to be mentioned shortly.

It was at this time during the late 1880's that Victor Horsley in England gave a great impetus to brain tumor surgery, and in fact established neurological surgery as a specialty by devoting most of his time and investigations to conditions of the nervous system. Although Horsley did not utilize the cranioplastic type of exploratory operation devised by Wagner in 1889, preferring to make a large, permanent bony opening in the skull, it should be noted that such a defect undoubtedly served a useful purpose at the time by affording a needed postoperative decompression. This was especially valuable when no tumor was found, as it relieved the patients of headaches and preserved their vision, important features which were stressed by Horsley in 1893.[12] Even as early as 1890, Horsley[13] was able to report operations on forty-four patients having brain tumors with only 10 deaths, a distinct advance over previous operative statistics.

Among many other contributions made by Horsley in the development of brain tumor surgery, his introduction of bone wax for controlling hemorrhage in the skull and the use of muscle implants for hemo-

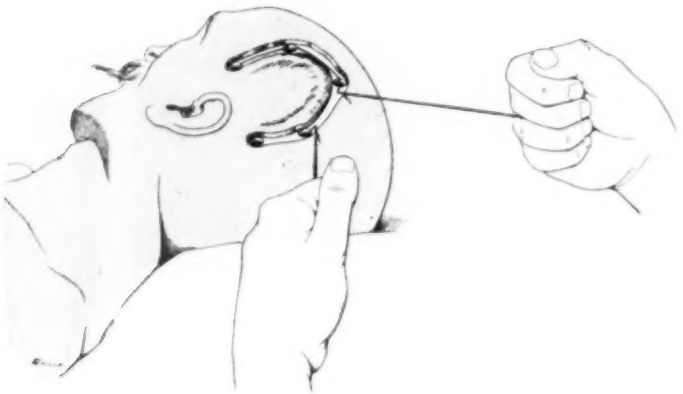

Fig. 1—Wagner's cranioplasty using the Gigli saw (after Marion).

stasis of cerebral blood vessels were outstanding.* His bone wax has been in constant use to the present day, and muscle implants were only superseded during the past eight years by the introduction of fibrin foam and gelfoam.

Another important point in relation to brain tumor surgery was Horsley's persistent insistence that patients having intracranial pressure symptoms should not be treated for many months with antisyphilitic medication as was the universal custom at the time in the hope that the cerebral lesion was a gumma. He reiterated the fact that such treatment was only rarely successful and that many patients with brain tumors continued to have headaches, and what was worse, usually became blind from optic neuritis during the course of medical therapy.

During the last decade of the nineteenth and the first decade of the twentieth centuries, operations upon brain tumors were performed with increasing frequency as the diagnosis became more widely recognized by neurologists who, in turn, sought the aid of their surgical colleagues, and for the most part informed the surgeon as to the area in the brain where the tumor was to be found. At first, small trephine openings were

* The consensus seems to indicate that Horsley was responsible for the introduction of muscle as a hemostatic agent in brain surgery. Borchardt, (quoted by Green and Stern in "A history of neurological surgery" edited by A. E. Walker) said in 1913 that he had been using muscle for this purpose for six years and gave credit to Horsley for having first used it. Cushing in 1911 stated that he had utilized muscle for hemostasis for two years. For our present purpose it does not matter greatly as to priority. The chief point is that sometime during the years 1900 to 1910 an extremely important addition was made to the armamentarium of the brain surgeon, and nothing took its place for twenty-five to thirty years.

made over the suspected region after elaborate craniocerebral measurements, and if no tumor was identified nothing more was done. However, following the introduction of Wagner's bone flap procedure, which was soon performed by using the Gigli saw (Fig. 1), or the generous removal of large areas of bone by forceps or chisel, more tumors were located and the use of topographical methods was gradually discarded.

Nevertheless, even in 1893, some four years after Wagner's introduction of the osteoplastic operation, we find some interesting remarks about the technique of brain surgery by M. Allen Starr,[14] an eminent New York neurologist who was one of the early American enthusiasts on the subject of operations for brain tumors. In his book on brain surgery Starr says: "Surgeons differ as to the best method of making an opening through the skull, but all agree that whatever opening is made should be at least one and one-half inches in diameter, and many prefer the opening two inches in diameter." Starr continues to give specific directions as to the further steps in brain operations, such as the control of bleeding from the diploë by plugging with gauze or decalcified bone or by Horsley's wax if the bleeding persisted. Hemorrhage from cortical vessels he says may be controlled by pressure, but if this is not adequate they may be tied with fine catgut or as a last resort the Paquelin cautery should be employed.

One or two other quotations from Starr's monograph are enlightening as to the general methods in use by the ablest surgeons at that time in this country when dealing with intracranial lesions. Starr comments, "If a tumor lies upon the surface, and is surrounded by a distinct capsule, it can be enucleated with the blunt point of curved scissors or with the finger without cutting. If it infiltrates the brain tissue and so has no distinct capsule, it should be cut out with the knife. The sharp spoon does not do good work in the brain. . . . If a cyst exists, it may be when superficial completely excised, or its superficial surface wall may be cut away and the remainder packed and healed by granulation." A further last bit of advice should be noted concerning the closure of a wound when there was great protrusion of the brain and closure seemed impossible. In such a dilemma ". . . the bulging brain may be sliced off or wiped away with a sponge."

Nevertheless, even with the increasing knowledge of the pathology and prevalence of brain tumors, and the more frequent attacks upon them, the results of the operations remained exceedingly poor and the

mortality continued to be prohibitive. Various analyses of collected reports concerning the accomplishments of brain tumor surgery were made by neurologists during the years 1900 to 1910. Two of the most notable of these were by M. Allen Starr, from whose earlier treatise I have just quoted, and by P. C. Knapp. Starr[16] made a survey of 365 cases in 1903 and from this study concluded that only the tumors which gave localizing signs would prove to be operable, or in other words, if localizing signs had not been present he believed that the growth was in an inaccessible brain area. He thought that operations for cerebellar tumors were useless, and came to the general conclusion of many others at that time that perhaps 5 per cent of all intracranial growths might be operated upon with a reasonably good result. However, it should be noted that Starr as well as many of the leading neurologists both in Europe and in America persisted in urging the surgeons to undertake operations on their tumor patients, realizing that this was the only possible chance for relief or cure.

One other noteworthy analysis of tumor operations was made by Knapp in 1906.[16] This consisted of 828 cases, some of which he had reported previously and others which he had collected from the literature up to that time. There were 265 deaths attributable to the surgical procedure, a mortality of 32 per cent or approximately one-third of the patients operated upon. "Removal" of the growth was thought to have been accomplished in 471 of the patients, but with the operative technique and the accessories then available it is quite obvious that in only a fraction of this number could the extirpation have been more than fragmentary. Furthermore, only a trifling percentage of the survivors were known to have recovered to the extent of living a useful existence. In 357 instances in this series of Knapp, the tumor was either not removed because it was thought to be inoperable for one reason or another, or doubtless in many patients no growth was disclosed.

Along with these reports by neurologists an important contribution to many aspects of brain tumor surgery was made by Charles Ballance of England in 1907.[17] Ballance had been associated with Sir Victor Horsley at the National Hospital in Queen Square and had assisted Horsley in the removal of the first intradural extramedullary spinal cord tumor in 1887. In his monograph of 1907 Ballance summed up his experiences with some 400 brain tumor operations, giving many detailed histories of his own patients as well as illustrative cases reported by

others. He was an early, if not the earliest, advocate of lumbar puncture during the course of an operation in order to reduce intracranial pressure so that less damage would be done to the brain and also so that retraction could be made more safely to disclose underlying lesions. Of perhaps greater importance was his observation that the so-called "mural nodule" or solid portion of tumor in the wall of gliomatous cysts had to be removed in addition to emptying the cyst in order to cure the patient. This fact was lost sight of by most operators until the 1920's. Among other notable tumor operations Ballance was able to report a patient from whom he had removed a cerebellopontile angle "fibrosarcoma" in 1894 and who was well twelve years later, except for her facial paralysis and trigeminal anesthesia.

Ballance made, for the time, an excellent working classification of brain tumors, dividing them into seven classes, as follows: 1) epiblastic; 2) mesoblastic; 3) secondary (metastatic); 4) cysts (including parasitic); 5) tuberculous; 6) gummas, and 7) vascular (including aneurysm). He thought that "a well defined and accessible tumour such as a fibroma or endothelioma of the meninges can and should be completely removed," and that the same was true for tubercles and gummas. He said of infiltrating tumors which were incapable of complete removal: "The gain after partial removal (of gliomas) is that the tumour grows more slowly." This is an interesting statement, but in my own experience I would feel that it is a rather rare occurrence.

Two other observations of Ballance deserve more than passing notice. He said that MacHill of Melbourne had collected thirteen cases of operation for hydatid of the brain in Australia, in six of which cure had resulted. This was unquestionably a great achievement for the time, although the method of packing the cyst with gauze for six days as used by Bird of Australia must have had its hazards.

The other noteworthy report given by Ballance is his reference to a case of brain tumor published by Mills and Pfahler in which the growth was localized by clinical study and by the roentgen rays. The illustration of this x-ray picture reproduced by Ballance is said to show a "dark shadow in the lower parietal region," but the dark area is extremely diffuse and not too convincing. He goes on to say that this was the second case in which the rays had localized a brain tumor, the first case having been reported by Church in the American Journal of the Medical Sciences for February 1899. In any case these are doubtless the

Fig. 2—Exposure of acoustic tumor by suboccipital bone flap (after Krause).

earliest attempts to utilize Roentgen's discovery for any type of intracranial diagnosis.

The whole attitude of this great pioneer English surgeon was one of hopefulness for the future as to what was sure to be accomplished for brain tumor patients. In speaking of these early days he said: "Up to the present, those of us who have worked in this field have been passing through a period of criticism, of opposition not always friendly, of many disasters, and of some great achievements." In spite of the discouragements, however, he was "convinced that the dawn of a happier day for these terrible cases has come."

During the twenty-year period of which we are now speaking, several large textbooks on neurological surgery appeared in English, French and German. In so far as intracranial lesions were concerned they dealt very largely with diagnostic and localizing methods, with much accent on various schemes of craniocerebral topography. In addition, these early writers, as was quite natural at that time, dwelt at great length upon the operative measures then in vogue for opening the skull, for both supratentorial and subtentorial lesions. There were many modifications or elaborations of Wagner's original osteoplastic craniotomy, some using the flap operation for cerebellar exposures (Fig. 2)

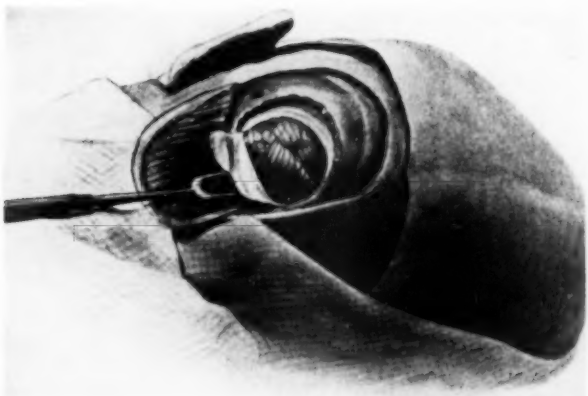

Fig. 3—Lateral position for cerebellar exposure (after Rawling, *Surgery of the skull and brain*. Reprinted by permission of the publisher, Oxford University Press, London, England).

while others removed bone permanently by forceps. The lateral position for suboccipital operations was stressed by several writers (Fig. 3).

Hemorrhage was controlled by thermocautery or by ligating vessels with silk or fine catgut, and when a tumor had been extirpated with the finger, the cavity from which it had been taken was packed with cotton or gauze. Some advocated leaving the gauze pack in place for one or two days, when it could be withdrawn and the wound closed with drainage (Broca[18]). This maneuver may have been life-saving at the time of operation, but undoubtedly led to infection and subsequent meningitis in a high percentage of cases. Furthermore, the principle of closing the strong galeal layer as well as the skin had not as yet been appreciated and in countless instances when increased intracranial pressure could not be relieved by tumor removal, or developed from subsequent edema, a cerebrospinal fluid fistula and eventual death from meningitis was almost inevitable.

In regard to the precise methods of tumor removal probably finger enucleation of encapsulated growths was the rule. This was employed particularly for meningiomas, but owing to the fact that much confusion had existed regarding their true nature some operators persisted in doing block dissections of bone, dura and tumor, while others made no attempt to remove what is now recognized as tumor involved bone.

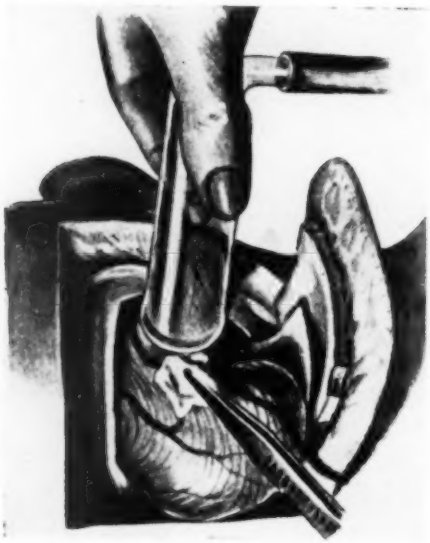

Fig. 4—Suction applied to tumor of cerebellopontile angle (after Krause).

We have noted that Horsley advised wide excision of even infiltrating gliomas, but little success was attained in this group unless by chance a large cyst was encountered with a slowly growing solid portion. Attempts were made to excise some gliomas using a knife or scissors or by the use of a spoon to scoop out large masses of soft tumors. Krause employed a large suction tube, and even utilized this method for acoustic tumors (Fig. 4). Many times, however, when an osteoplastic flap had been turned down either no tumor was found or sufficient growth could not be removed to reduce pressure, so the flap had to be sacrificed. This was not always as detrimental as it might appear, since in such instances there was no fear of a postoperative clot due to oozing from the bone—a factor of great importance in the earlier days before methods to control this complication became available. Removal of large bone areas in this way served as decompressions and in many cases relieved headaches or preserved vision. It was noted earlier that Horsley had been employing such bony removal by preference at least as early as 1893 but later deliberate decompressions under the

muscle of the right temporal region as advocated by Cushing in 1905[19] came to be the procedure of choice for unlocalized growths.

From the foregoing statements and quotations one may acquire a general picture of the outlook in brain tumor surgery up to about the end of the first decade of the twentieth century. In brief, since the introduction of anesthesia and of our knowledge of more specific cerebral localization together with the antiseptic principles of Lister, a beginning had been made and a few brilliant successes had been achieved in attacking intracranial new growths which heretofore had been completely hopeless lesions for which there had been no possibility of relief, to say nothing of cure. These early operations had been carried out by the more outstanding and courageous surgeons of the times but using such general surgical methods to which they were accustomed without, as yet, having developed any special techniques which would render the operations themselves or certain postoperative complications less hazardous.

Furthermore, it should be noted that no surgeon, with possibly one or two exceptions, had as yet followed the advice given by von Bergmann in 1889 when he had urged those who undertook operations upon the brain to familiarize themselves with neurologic diagnosis in order that they could treat their patients more intelligently. For the most part the diagnosis and localization of brain tumors was carried out by the neurologists, who then turned the patient over to the surgeon who operated in the area indicated to him by the neurologist. By the means then in vogue it was estimated that between 5 and 10 per cent of brain tumors were operable. The operative mortality under the best of circumstances ranged from 35 to 50 per cent, some 10 per cent of the deaths being due to meningitis.

From about the year 1910 and the subsequent ten years, certain major advances were forthcoming in neurosurgery generally, and particularly to the surgery of brain tumors. This decade, as well as the following one from 1920 to 1930, may well be called the American era of this specialty. It was during this period that the great pioneer neurosurgeons of our country, led by Harvey Cushing, Charles Elsberg, Charles Frazier and Walter Dandy—to mention only those who are no longer living—developed the techniques and certain diagnostic methods which with some minor modifications and additions are generally in use at the present time. What might be called an American school of

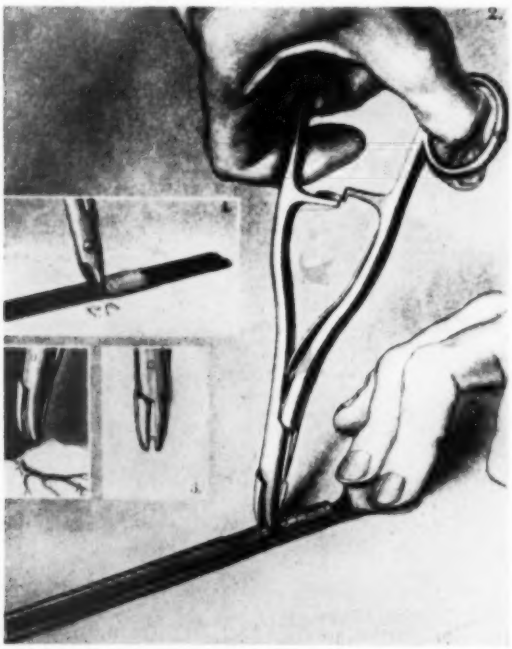

Fig. 5—Original illustration of Cushing's Silver clips (Ann. Surg., 54:1, 1911. Reprinted with permission of J. B. Lippincott, publisher).

neurosurgery was gradually established by these men in great measure, and for the first time in the history of medicine in this country surgeons from all over the world began coming to America to learn our methods of dealing with surgical lesions of the nervous system.

This is not the place to dwell too greatly with personalities, but in all fairness I think it may be said that Harvey Cushing furnished the chief impetus to the notable improvements in brain tumor surgery which took place beginning at about the end of the first decade of this century. Cushing had been impressed with the meticulous blood saving technique and extreme care in the handling of tissues as taught by Halsted in Baltimore and he immediately brought these principles to bear in dealing with operations upon the brain. In 1911 he introduced the use of silver clips for hemostasis of dural and cerebral blood vessels (Fig. 5), and all through these early years he insisted on using moist cotton instead

of gauze in making pressure on the brain, and what was more important, closed the galea with buried silk sutures in addition to closing the scalp. This latter maneuver, at one stroke, practically eliminated the breaking down of wounds, with subsequent infection and death from meningitis.

At the Seventeenth International Medical Congress in London in 1913, Howard Tooth[20] produced some figures concerning the results of operations upon 265 brain tumors at the National Hospital, Queen Square. These were presumably Victor Horsley's patients very largely, and the tumors were verified in 187 instances. The operative mortality was 44 per cent, but the fact that 31 (16.5 per cent) of the 187 patients had lived from nine months to nearly ten years, according to Cairns, indicates a distinct advance over other previously reported series.

However, it was only a year after this analysis that an amazing advance was recorded so far as mortality statistics in brain tumors were concerned. At the meeting of the American Medical Association in 1914, Professor Küttner, of Breslau,[21] read a paper on his experiences with 100 brain tumor operations, stating that his own mortality was 45 per cent, and giving the figures from Eiselsberg's Clinic in Vienna at 38 per cent and those of Krause in Berlin at 50 per cent. In discussing this paper, an elaboration of which was published in 1915, Cushing[22] reported his almost unbelievably low mortality rate of 6.6 per cent for cerebral and 17 per cent for cerebellar tumors, a total combined figure of 8.4 per cent. The reasons for this success were the fundamentals already noted, namely, extreme care in hemostasis, the meticulous handling of cerebral tissue and closure of the galea in addition to the scalp. Cushing had lost but one patient from meningitis, whereas, as we have seen, this was the cause of death in some 10 per cent or more of operations elsewhere.

Let us turn now to some of the more specific advances in dealing with particular types of tumor during the decade we are considering from 1910 to 1920. Although attempts had been made as early as 1889 by Horsley to expose pituitary tumors, using an intracranial route, and similar procedures were used subsequently by Hartley, Kiliani and Krause, little if anything was accomplished for the patients, and it became obvious that a new type of approach would have to be undertaken. A transphenoidal operation by Schloffer in 1907[23] was the immediate answer to this problem. The technique of this approach underwent modifications between 1909 and 1910, notably those of Kocher, of Kanavel, of Eiselsberg and of A. E. Halstead, and this became the stand-

Fig. 6—Transphenoidal operation for pituitary tumors (Cushing, J. A. M. A., Oct. 31, 1914. Reprinted by permission).

ard procedure used in this country very largely for many years (Fig. 6), although Frazier in 1912[24] introduced the forerunner of the present transfrontal operation and used it for certain cases instead of the transphenoidal. In 1914, Elsberg[25] described a more cosmetic operation of this type. Hirsch of Vienna[26] had introduced his endonasal transphenoidal method in 1910 and he still uses it with considerable success.

These attacks on pituitary adenomas through the sphenoid cells at times were highly successful in saving or restoring vision for long periods in suitable cases, and the operation represented a distinct advance over the intracranial approach as it was done originally. However, the amount of tumor which could be removed was always problematical due to the extremely limited visualization of the lesion through a small opening in the base of the sella turcica, and nothing of value could be accomplished for adenomas which had extended up into the intracranial cavity. The operation nevertheless was a relatively simple and fairly safe procedure, carrying a mortality between 4 and 5 per cent, but because of its obvious limitations and because of perfected technique in doing the intracranial exposure, most neurosurgeons since the later 1920's have used the transfrontal procedure exclusively. By this means a much better exposure of the lesion is obtained, and for the adenomas which have not spread

extensively into the intracranial cavity the mortality is less than by the transphenoidal method. In addition, much can be accomplished for some of these extensive lesions at times, although in such instances the risks are much greater.

The pathology and natural history of meningiomas or dural endotheliomas as they were then called became fairly well understood between 1910 and 1920 and their relationship with bony invasion and reactions as well as their benign character was recognized. Better technique for their removal became more prevalent. It was found that they could be gently separated from the brain by pledgets of cotton, and then lifted or tilted out without introducing the finger around them as this latter maneuver often caused considerably more brain damage and subsequent edema. The surrounding vascularity was still a great hazard and at times excessively difficult to cope with, since there was no electrocautery and even a single transfusion was an undertaking which frequently took too long or was unsatisfactory in one way or another. Surgical shock was, therefore, a constant factor and for this reason multiple sessions were the rule rather than the exception. Nevertheless, the outlook for patients having meningiomas became increasingly bright and even some which had invaded the large dural sinuses were completely excised with resection of the involved sinus.

A marked advance was made in the treatment of acoustic neuromas by the introduction of intracapsular enucleation of those benign tumors in 1917.[27] It had long been recognized that these lesions were encapsulated and noninvasive, but previous attempts to remove them by finger dissection had with rare exceptions ended disastrously. Thus, the prevalent mortality of at least 75 or 80 per cent was naturally sufficient to make some neurologists feel that a surgical attack upon them was hopeless and not justified. Using a bilateral "crossbow" incision, and by scooping the growth out from inside its capsule, thus not damaging the adjacent blood vessels and cranial nerves, it was found that the mortality rate could be reduced to something like 10 per cent. It should be said at once, however, that 50 per cent or slightly more of the patients died of recurrence or secondary operations within five years, although many of the remainder lived useful lives for ten or fifteen years or even longer. The intracapsular procedure, therefore, served a most useful purpose for the time and offered patients harboring these lesions at least a "run for their money" which they had not had before. However, as we shall

see, an operative method for the complete removal of these tumors was forthcoming shortly.

The first World War was doubtless responsible for three signal improvements in neurosurgical technique and thus a development toward better brain tumor surgery. I refer particularly to the use of procaine anesthesia and of the sitting postion as employed and advocated, especially by de Martel of Paris, and the introduction of suction for intracranial surgery. A procaine solution containing a few drops of epinephrine to the ounce injected into the scalp and underlying muscle reduced bleeding from these structures to a considerable extent, and with occasional small hypodermics of morphine, operations could be continued many hours, thus partially eliminating two and three stage procedures for some of the long tumor removals. Although the sitting position had been advocated as early as 1889 by Knapp and Bradford, this method of reducing venous bleeding in intracranial operations was not taken up to any great extent until emphasized by de Martel. It is still by no means in universal use but is gaining in popularity, particularly for operations on cerebellar tumors, and has for many years proved invaluable for other procedures within the skull, such as sensory root section for trigeminal neuralgia.

The employment of a strong suction apparatus in neurosurgery became quite general after the war of 1914 to 1918, doubtless as a result of seeing what could be accomplished in debriding gunshot wounds of the brain by hand suction devices during the conflict itself. We have noted that Krause had used a large glass suction tube for tumor removal during the 1890's, but this method was either lost sight of or not found generally expedient. It has now become standard and invaluable equipment, not only as an adjunct in the removal of soft infiltrating gliomas, but especially for keeping the field of operation dry so that bleeding vessels can be rapidly visualized and controlled in one way or another. It would seem to me that as an aid to tumor removal as well as to neurosurgical technique in general, the introduction of strong suction has proved to be one of the major steps in our attacks upon brain tumors.

In 1918 and 1919 respectively, two brilliant diagnostic measures for the localization of brain tumors and other neurosurgical lesions were reported by Walter E. Dandy of Baltimore, namely, the procedures known as ventriculography and encephalography.[28, 29] Following the injection of air into the cerebral ventricles by direct puncture or into

the spinal and cerebral subarachnoid spaces by the lumbar route, Dandy found that practically all brain tumors whose situation could not be determined by neurological means could be thus localized, or their site determined with more exactness than had been possible hitherto. At the time there was considerable doubt among neurologists and neurosurgeons concerning the use of what seemed such a radical and possibly dangerous procedure, especially as several deaths following air injections were reported in various clinics. However, it was soon learned that if the craniotomy for tumor removal was undertaken directly after the injection had been made and the x-rays read, any danger was reduced to a minimum, and Dandy's discoveries were gradually but finally enthusiastically adopted by all neurosurgeons as initiating a new era in tumor localization. No longer were palliative decompressions for unlocalized growths necessary, although they still were performed in cases of certain infiltrative gliomas which were thought to be inoperable, a biopsy only being done at the time of operation.

We now come to the decade from 1920 to 1930 which was a period of very great development in brain tumor surgery. Following ventriculography, as just noted, practically all tumors could be located exactly, and this meant that many subcortical growths could be approached by incising the brain over them even when they were at a considerable depth below the surface, a procedure which had been done to some extent previously only when there was widening of the convolutions over the suspected area, and even then with many misgivings as to whether tumor would actually be encountered. Furthermore, such tumors as colloid cysts of the third ventricle, and other growths lying within the lateral or third ventricles, previously seen only at autopsy, were discovered and often successfully extirpated (Fig. 7). In dealing with some of these deep-seated lesions it was found that more room was necessary for their exposure than was afforded by simple incisions through the cortex; hence it was learned that considerable amounts of so-called silent brain areas could be excised without detriment to the patients in order that the tumor could safely and completely be removed.[30] Such bold measures are likewise attributable to Dandy and he also introduced in 1922 an operation for the complete removal of acoustic tumors.[31] By a unilateral approach the tumor content was first scooped out as in the intracapsular procedure, after which the capsule itself was carefully withdrawn from its adherence to the pons and the

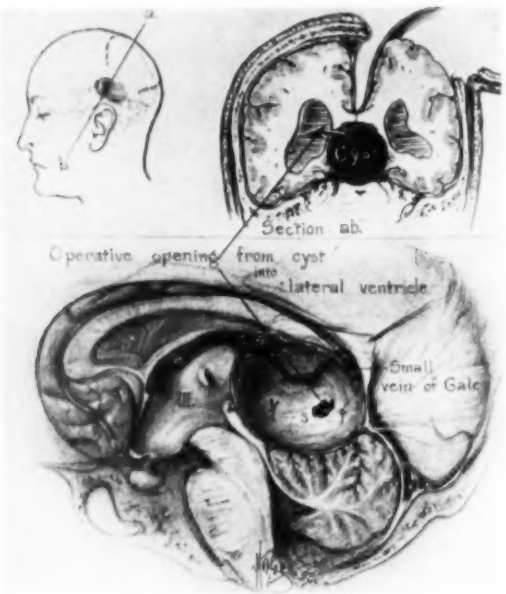

Fig. 7—Cyst of posterior third ventricle showing opening from cyst into ventricle (from Dandy, W. E. Benign tumors of the third ventricle of the brain, C. C. Thomas, Springfield, Illinois, 1933. Reprinted by permission of the publisher).

neighboring cranial nerves. Although the facial nerve is almost inevitably sacrificed by complete removal of these tumors, nevertheless a subsequent anastomosis of the facial with either the hypoglossal or spinal accessory nerves minimizes the disfigurement, and when patients are told the facts as to what an incomplete operation means, they accept the situation philosophically. At times the facial nerve can be spared as noted recently, particularly by Olivecrona of Stockholm.[32] Complete extirpation of acoustic tumors when done with care and patience, and especially now utilizing the sitting position, can be accomplished with as little or less immediate mortality than is the case with the intracapsular operation, while the five year mortality is nil as compared with over 50 per cent by the older method. Furthermore, it has been shown that 75 per cent of the survivors live useful lives for five to fifteen years or more compared to possibly somewhat over 50 per cent of those having

incomplete operations.[33]

In 1926, a classification of the glioma group of tumors was put forward by Bailey and Cushing[34] and the different types of gliomas were correlated with the clinical histories and course of the patients in each group. This was a valuable step in our knowledge of these numerous and varied growths and was doubtless responsible for a more vigorous and radical attack upon the more slowly growing ones, especially the oligodendrogliomas and some of the astrocytomas. It was found likewise that certain tumors, notably the medulloblastomas of the cerebellum, were surprisingly sensitive to radiotherapy, at least for a period, sometimes as long as five or more years, although these lesions always recurred eventually. In the interval, however, the patients recovered and were completely free of their intracranial symptoms. During these early years, radiation was tried extensively on nearly all types of brain tumor, but with the exception of the medulloblastomas, the pinealomas and some of the pituitary adenomas, it has not proved very effective, and because of its uncertainty with the other tumors as well as the added expense in time and money to the patient, its use has been greatly limited. Because of its value in the medulloblastomas, and because a fair percentage of cerebellar lesions in children are of this type, proposals have been made to treat all presumed cerebellar tumors in children by x-radiation before operating upon them and verifying the growth, but this seems a highly unwarranted procedure, since some of the children having other types of conditions in the cerebellum might get into serious difficulties during the course of radiation, and, in fact, disastrous results have been known to follow in patients treated in this way.

Another technical advance made in the 1920's was in the radical cure of certain cystic astrocytomas and hemangioblastomas. As noted earlier, Ballance had maintained as far back as 1907 that excision of the solid portion in the cyst wall of these tumors was essential in order that no recurrence should take place, but apparently his dictum was lost sight of to a large extent, or in many instances the removal of these so-called mural nodules was believed to be impossible. Furthermore, in the case of hemangiomatous cysts it was not appreciated until about the decade of which we are speaking that the solid nodule of tumor might be so small as to escape notice unless searched for with great diligence, the lesion passing for a simple cyst of unknown etiology. Previous to the routine search for and removal of these mural nodules the cysts

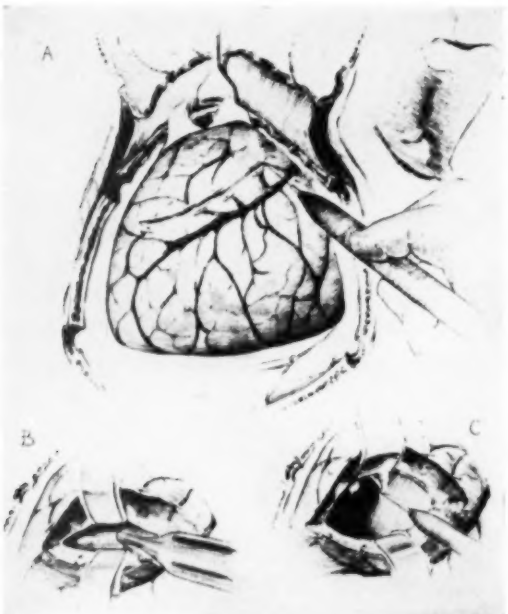

Fig. 8—The application of electrosurgery in the removal of solid tumor in the wall of a cyst (from Horrax, G., Nelson's Loose-Leaf System of Surgery, Thomas Nelson and Sons, New York, 1933. Reprinted by permission of Williams and Wilkins Company, Baltimore, Md., the publishers of Nelson's Loose-Leaf System of Surgery).

were opened and at times an effort was made to destroy the cyst wall with strong fixatives such as solutions of formalin or Zenker's fluid. After the advent of electrosurgery in 1927 the excision of the solid portion of cysts was greatly simplified and it was realized that when this had been accomplished it was unnecessary to do anything to the cyst wall in order to effect a cure (Fig. 8).

This brings us to what was perhaps the greatest technical adjunct of the 1920's of which mention has just been made, namely, the use of electrosurgical current both for cutting and coagulating purposes. An instrument of this type was developed by Bovie in conjunction with Cushing, and its usefulness in brain tumor surgery reported in 1927[35] and 1928.[36] The apparatus has been perfected and to some extent simplified in the course of years, and at present is connected with a metal suc-

tion tube so that a dry field can be maintained simultaneously with the application of the current at the end of the suction tube. This enables the operator to see the source of bleeding and at the same time to coagulate the vessel without the loss of valuable time, and this method for the control of hemorrhage has done away very largely with the use of silver clips, although under certain conditions the latter are indispensable.

It would be difficult if not impossible to overestimate the value of this combination of strong suction and electrosurgical methods in so far as the removal of brain tumors is concerned. It was rapidly made use of to attack growths such as olfactory groove meningiomas as well as those arising from the tuberculum sellae. Again by first removing a considerable portion of the inside of these tumors with the electric loop their size was reduced and the remaining shell could then be gently freed from the surrounding blood vessels and withdrawn. In this way success became the rule rather than the great exception when these large vascular and inaccessible growths were encountered. Preliminary lobectomies for the exposure of such large tumors were accomplished quickly and easily by electric coagulation and in a few instances even hemispherectomies were performed in the hope of curing extensive infiltrating gliomas.

Let us consider now the latest era of brain tumor surgery, and for our present purposes we may put into this category the two decades from 1930 to the present time. In a general way this period may be thought of as one during which all the previous advances have become consolidated and, in addition, several far-reaching discoveries which have played important parts in lowering operative mortality have been made.

During the twenty years in question many minor refinements in technique have been brought forward, and probably more thought has been given to the cosmetic result after tumor operations than was the case when a successful removal was the prime consideration and cranial defects, either large or small, were accepted as incidental. Now these defects are repaired immediately either with some form of metal or plastic substance, scalp incisions are concealed within the hair line whenever possible, and even the small openings made by the burr for craniotomies are filled in with bone dust or metal buttons.

Among other publications dealing with perfection of technique, a paper by Elsberg in 1931[37] concerning the origin, blood supply and methods of removal of meningeal fibroblastomas (meningiomas) was outstanding. He likewise published an important paper on quantitative

olfactory determinations for tumors involving the sense of smell, and a diagnostic syndrome for small meningiomas of the sphenoid wing.[38,39] Articles on conserving the facial nerve in operations for acoustic tumors appeared (Cairns[40]), and a fairly high percentage of spared facial nerves in this procedure has been reported from Olivecrona's Clinic in Stockholm.[32] From the same clinic likewise there have been encouraging examples under certain conditions of a radical attack upon extensive cerebral angiomatous malformations.[41] Other tumors such as pinealomas, which for many years had resisted all attempts at their removal, have in a few instances been extirpated with useful survival for many years, although some tumors in this situation in the posterior part of the third ventricle are apparently highly radiosensitive and perhaps may prove to be permanently cured by the roentgen ray.[42] For others, the palliative procedure of Torkildson or an anterior ventriculostomy has proved helpful at least for a time.

In many clinics during the past twenty years local anesthesia which was used quite generally for a time in neurosurgical operations has been given up and replaced by intratracheal ether or in some cases by intravenous pentothal. A distinct advantage of the intratracheal method is that when there is respiratory difficulty, artificial respiration can be given, simply, easily and immediately without dismantling the drapes or stopping the operation, as was formerly the case when manual artificial respiratory methods had to be utilized. This transformation in anesthesia has come about by the advent of highly trained anesthetists who have played an important role in lowering the operative mortality in this as in other branches of surgery. By careful control of ether consumption, which is kept down to minimal amounts, operations may be continued for many hours without fear of difficulty from this source.

A further and great step in lowering operative mortality has been the institution of blood banks and thus the availability of multiple transfusions. It is obvious, of course, that the greatest care should be taken in conserving the patient's own blood, but in some of the more vascular brain tumors considerable blood loss is inevitable. Before blood became available, as at present, many patients either died of shock or were subjected to multiple operations before their tumors could be removed safely. Both of these eventualities have now been well nigh eliminated, and this development is doubtless attributable to lessons learned in the last world war.

Another discovery which was likewise a result of investigations made during the recent war was the production of fibrin foam[43] and later of gelfoam[44] for hemostatic purposes. These substances have proved to be of incalculable value in brain tumor surgery, particularly in controlling the general oozing from the tumor bed, as well as for bleeding from dural veins and large dural sinuses. In certain places, also, absorbable oxycel gauze or cotton has been found to have definite usefulness, all these products having now replaced the use of muscle almost entirely.

As in all surgery, so in our specialty, the advent of antibiotics has been a godsend to both patient and surgeon;—to the patient obviously, since the antibiotics have cut down to a minimum the risk of infection and death from meningitis. But I include the surgeon in this statement likewise, because who among us after toiling through many long hours of a tumor removal has not lived in fear during the subsequent several days that even after the most exhaustive care in technique the patient might have a sudden temperature elevation along with other signs of meningeal irritation and eventually be lost in spite of all previously known measures? And along this line it should be noted that the removal of tuberculomas of the brain has now been accomplished without the almost inevitable sequence of tuberculous meningitis and death, thanks both to electrosurgical excision and the use of streptomycin.

Although the discovery of arteriography had been announced by Moniz[45] shortly before 1930 it has only come into general use during the past twenty years, but during that time its usefulness as a diagnostic measure has increased enormously and certainly represents a major adjunct in our armamentarium. It was first employed for the demonstration of vascular lesions such as aneurysms and angiomas, or to differentiate between a possible cerebral thrombosis and tumor. It has now even replaced air studies to some extent, and although occasional serious complications have been reported, these have been reduced to an extreme minimum by various technical improvements.

Although intracranial aneurysms are not, strictly speaking, what we are considering as tumors, nevertheless they do represent space-consuming lesions inside the skull, and, therefore, a word should be said about them. In this country, at least, they came to be recognized more generally after the publication of a paper by Sir Charles Symonds[46] who is now a distinguished British neurologist, and Sir Geoffrey Jefferson of Manchester, England,[47] has made important observations in respect to their

diagnosis and treatment. In addition to ligation of the common and internal carotid arteries in the neck, which at first were thought to be the only possible useful surgical procedures for these lesions, it has been shown, especially by Dandy[48] and by Poppen,[49] that in certain instances aneurysms could be attacked and cured by an intracranial approach.

One other aspect of neurological surgery and its bearing on the surgery of brain tumors is of considerable importance. As the scope of our specialty has widened, an increasing number of young men have been highly and carefully trained for this work in most of the countries throughout the world. This means that not only are more brain tumors being recognized because of greater familiarity with their symptoms and the spread of knowledge as to what may be accomplished for them, but also that many patients who, for one reason or another, were unable to get to one of the large centers, are now taken care of within a short distance of their homes. Doubtless many lives have been saved in this way and the patients returned to useful work, whereas previously they might never have had the benefits of surgery.

In conclusion it should be reiterated that many factors and many individuals have been responsible for the enormous advances which we have seen come to pass almost within the lifetime of many of us who have been engaged in this work. We must always look back upon and pay tribute to the pioneers in all countries in their struggles to save patients who were suffering from what in those early days were thought to be well nigh hopeless intracranial lesions. Without our modern equipment and adjuncts it is difficult, if not impossible, for us to realize what courage it required to face situations which they were aware might suddenly get beyond their control and end disastrously.

Among these pioneers was Charles A. Elsberg, the man whom we honor this evening. He not only saw the surgery of brain tumors develop beyond anything which could have been visualized at the turn of the century, but was a large and constant contributor to our total sum of knowledge of this subject. But what he would have looked forward to, as do the rest of us, would have been the time when even our present methods would seem outdated, and by newer procedures and greater knowledge we might be able to attack successfully some or all of the malignant types of tumor for which at present there is no adequate therapy. At the moment it does not appear that even the most radical surgical measures are likely to succeed so far as the extensive infiltrating

gliomas are concerned. About all we can do, therefore, is to prolong the lives of patients having such tumors by as radical surgery as seems warranted in any individual case without impairing existing functions, in the hope that some further development of radiation therapy or of chemotherapeutic agents may change our entire outlook on this group of intracranial new growths.

As another pioneer in neurosurgery said in 1938 speaking of the surgery of meningiomas: "Meanwhile new methods will almost certainly have been introduced which in all likelihood will make our survival percentages for the final 1927 to 1932 period by comparison appear to be amateurish and the work of tyros."[50]

What then, in summary, can be said as to the development and accomplishments in brain tumor surgery since its advent in the latter part of the last century? Leaving aside the very earliest attempts at tumor removal when only an extremely occasional enduring successful result was achieved, the persistent and widespread attack upon intracranial growths may be said to have started at the beginning of the twentieth century, or roughly the last forty to fifty years. In the first decade of this era it was estimated by those most familiar with the subject that not over 10 per cent of all brain tumors were capable of being operated upon and since the prevailing operative mortality at that time was in the neighborhood of 50 per cent, it meant that only 5 out of every 100 patients would survive the immediate operative procedure. It may be doubted whether more than 2 or 3 per cent of the survivors continued in useful life with little or no deficit.

In contrast to this, we now know that at least 40 to 50 per cent of patients with brain tumors have lesions of a benign character which in most instances can be eradicated surgically with an operative mortality approaching 10 per cent, or in some cases even less. Furthermore, a large number of these, probably 65 to 70 per cent, will be in relatively normal health permanently and capable of resuming their usual activities.

Of those patients not having tumors which can be permanently dealt with, a fair number can be relieved for reasonably long periods, sometimes up to ten or even twenty years, either by radical surgery alone or by a combination of surgery and radiation therapy.

Let us look forward to a happier day for those whose lesions have thus far eluded all our attempts to deal with them successfully.

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PSYCHOANALYSIS AND THE STUDY OF CREATIVE IMAGINATION*

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"CREATIVE IMAGINATION" indicates a mental property which we usually connect with achievements in the arts, in the broadest sense of the word. But scientists and "thinkers" also rely upon creative imagination during certain probably crucial phases of their work; and in one way or another this same mental property may manifest itself in the personal or professional lives of us all.

Common to all manifestations of creative imagination, in the first place, is subjective experience. This tends to be infinitely differentiated in intensity and duration and to appear as an ingredient or accessory in many moods. Three characteristics of this experience seem outstanding.

First: Subjects are aware of the limitation of conscious effort.

Second: They are aware of a specific feeling. It is never a neutral one. There is always some, and frequently a very high, emotional charge involved.

Third: Even if excitement rises, the mind tends to work with high precision and problems are easily solved. If we adopt a broad meaning of the term "problem solving" we can say that some "problem solving" is always going on, even in art.

A further common element concerns not the subject's experience but the reaction of others to him. Wherever creative imagination is at work for better or worse it tends to establish some distinction between the one and the many.

This is not, I know, a satisfactory and certainly not an exhaustive description. However, a certain vagueness may not be out of order since we are dealing with a difficult topic. And in the end, the impression must and should prevail that, significant as the contribution of psychoanalysis is, it is limited in various ways. We have started on a

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voyage with our course largely uncharted.

I shall attempt tonight to characterize the contribution of psychoanalysis to the study of creative imagination with particular reference to art—art in a very broad sense—and loosely follow the guide of the history of psychoanalysis, since its contributions to the study of creative imagination constitute an important part of this history.

The present position of psychoanalysis, its status in science and society, offers a starting point. We shall characterize this status by stressing two aspects. There is one which will hardly preoccupy us tonight. Largely based on psychoanalytic insight for some twenty years a movement has been under way which later historians may well decide to describe as the "Psychiatric Revolution." There is, for one, the rise of psychiatry within medicine, the obsolescence of a rigid distinction between the "physical" and the "mental" in approaches to illness, in the emergence of psychosomatic medicine; there is, moreover, the ever broadening concept of mental health itself, modifying procedures in education and transforming our views on welfare to the point where charity as an institution has come to include considerations of the individual's psychological balance. During the last decade these and other related trends seem to have converged into one direction. It is this, that therapy is gradually being supplemented by prevention; and a program which has existed in a somewhat utopian sense since the earliest days of Freud's work is, thus, being carried further. The second aspect of the current status of psychoanalysis is externally characterized by the growing contact of psychoanalysis with other disciplines. It is not a contact in which psychoanalysis and sociology, anthropology or political science—to mention only some currently much emphasized examples—establish an interdisciplinary cooperation, but rather one in which psychoanalysis provides the focal point for a new science of man of which the outlines are here and there visible. Psychoanalytic therapy and psychoanalytic psychiatry in general provide the most essential set of data in the building of this new science.

How did this come about, how could two so far-reaching developments grow out of one root, originally out of the experience of one investigator?

I here turn to a quotation from Freud's earliest writings which describes his own reflections on the first extensive psychiatric case histories which he presented to the public after considerable delay, in the

fall of 1895: "I have not always been a psychotherapist, but like other neuropathologists I was educated to methods of focal diagnoses and electrical prognosis, so that even I myself am struck by the fact that the case histories which I am writing read like novels and as it were, dispense with the serious features of the scientific character. Yet I must console myself with the fact that the nature of the subject is apparently more responsible for this issue than my own predilection. Focal diagnosis and electrical reactions are really not important in the study of hysteria, whereas a detailed discussion of the psychic processes, as one is wont to hear it from the poet, and the application of a few *psychological formulae*,† allows one to gain an insight into the course of events."

These words describe the scientist's struggle with a new and particularly challenging subject matter. It was not, as Freud thought at the time, one syndrome or one illness; it was the study of man's psychological conflict, an age-old topic and part of the tradition of Western civilization. Freud's predecessors were not scientists; they were the masters of intuitive insight, poets, writers and thinkers. Closest to Freud's formulations are those of some of the great men of the century of his own youth, the formulations and approaches of Schopenhauer, Nietzsche, Dostoievsky, and those of some minor, and yet very great men, like Samuel Butler; the coincidences which we observe are largely rooted in the similarity of cultural predispositions. This in turn makes us aware of the fact that the demand of the age and the creative effort of the individual must be in some harmony with each other; creative imagination can in some measure anticipate the future, but in empty space, out of tune with at least hidden trends, genius will not emerge; his work must fit into the structure of the problems which he solves, with which he struggles and which he modifies.

In Freud's work the confines of sciences were widened; an area of phenomena never before approached scientifically was investigated through the formulation and testing of hypotheses. The practical consequences of this step were to be seen in the enlarged orbit of therapeutic intervention, the slow, steady, and uninterrupted progress of the therapeutic technique of psychoanalysis during almost six decades, and the more recent development of psychotherapy in psychoanalytic psychiatry. In one point, at least, these developments were different from those in most other fields of medicine. When unhappiness and self-made

† Author's italics.

destiny proved in some instances to be amenable to therapeutic intervention, not only a cure of illness was offered, but also a cure where previously the existence of illness had not been recognized. The widening of the perimeter of science has, thus, led to a widening of the confines of medicine itself.

Let me briefly characterize some of the consequences of Freud's first steps for the development of psychoanalysis as a theory. The few "psychological formulae" to which he referred in the passage quoted above expanded rapidly into a cohesive set of propositions. At first, Freud could borrow his main conceptual tools from the area of his previous interests, neurophysiology. The general approach, the idea of seeing human conflicts in terms of an interplay of forces, the distinction of various types of discharge processes and of principles regulating the economy of psychic energy, were derived from this field. But the therapeutic experience with psychiatric cases forced upon Freud not only modifications of his early concepts, but also a radical extension of his approach. Two interconnected observations became of decisive importance: the realization that earliest experiences tend to leave lasting imprints on personality development; and the recognition of the role of instinctual drives, particularly in connection with the earliest phases of development. The realization of the importance of man's early total dependence on maternal care, unique amongst mammals, led Freud to supplement his physiological by a biological approach. But this biological approach received in Freud's context a new dimension. It is not limited to the consideration of genetic, biochemical or physiological forces within man; it includes also the continuous social influences upon the growing human organism. In this approach the dichotomy between the biological proper and the social is eliminated as spurious, a dichotomy which in the past had obscured many psychological formulations. There are still those who tend to re-emphasize its existence and thus to support the distinction of two kinds of sciences, natural and social sciences. The position of psychoanalysis as scientific theory and that of psychoanalytic psychiatry as therapy and hence as source of data, illustrate the value of an approach which has made it possible to integrate various fields of investigation around a core of central assumptions. The fact that the committee of the New York Psychoanalytic Institute responsible for the Freud lectures has selected as its topic for this year one which demonstrates the range of psychoanalytic thinking, may well be taken

as evidence that the integrative potential of psychoanalysis seems to us to be one of the most valuable parts of Freud's heritage.

The psychoanalytic contribution to the study of creative imagination should be seen with this in mind, as a contribution to an inquiry basic to any science of man. This view has determined the selection of the topics which are to be discussed as examples; they deal with phenomena of the nature of art, and art in turn is viewed as a particular, and as the most complex, type of communication in society.

I shall deal with three problems for which I have chosen the following headings.

First: The Problem of Thematic Generalization.

Second: The Emotive or Esthetic Potential.

Third: Creative Communication.

The *first* topic, the problem of *thematic generalization* is concerned with narration whatever the mode of presentation; it is story-centered and hence deals largely with content. The starting point is the relative uniformity of all narration, of myth, folklore, fairy tale, novel and even drama, or, to put it more cautiously, the very high frequency of recurrent themes.

Previous explanations accounted for this recurrence mainly by two interdependent types of inquiry: thematic similarity was explained by pointing to historical reasons, to the migration of accounts and thus to the influence of one narration upon others. Influence, however, posits a predisposing factor, a universal experience which explains the readiness to accept influence. As such experience, the reactions to cosmological and physiological cycles in nature and man have been most thoroughly investigated. Both the historical and the cyclical explanation is not superseded by the approach of psychoanalysis, which relates the uniformity of themes to the uniformity of conflict-patterns in man's life. This uniformity is rooted in what I mentioned as the biological approach in psychoanalysis. Hence the uniformity of conflict patterns does not refer mainly to the conscious experience of the adult but largely to the experiences and hence also to the thought-processes of the child. Universal human experiences, modified by specific conditions of the cultural environment, account for the extent to which the themes of narration tend to resemble each other.

The typical content of many of these themes was first discovered in the reconstruction of childhood fantasies during the psychoanalytic

investigation of adults and later elaborated in the observation of the growing child. We are familiar with the emergence of many such typical fantasies as the response of the child to the riddles of his own existence and to those of the adult world surrounding him: riddles not only in an intellectual sense, although this is part of it. For there is also the inherent conflict of many of the child's most basic strivings with each other and with his environment, there is, moreover, the task of adjusting to a social world in which one is still a child with wishes and desires no less intense and even more unbending than those of the adult.

The best-known coincidence between myth or great narration and individual fantasy concerns accounts which have the hero of miraculous descent, separated from his original parents, adopted by foster parents up to the day when he splendidly emerges. These accounts, widely spread in Western and particularly Mediterranean tradition but frequent also in other cultures, have lost nothing of their emotional relevance.

Some 30 per cent of the Americans of this generation are consciously aware of having thought of themselves at some time between the ages of five and fifteen as adopted or foster-children, and of having invented "true" parents of higher or—much more rarely—of lower status. There is hardly a psychoanalytic treatment, where some such fantasy fails to play its role; some of its parts tend to have remained conscious; other, dynamically more significant, parts tend to be repressed. The very fact that I can here quote percentiles of the occurrence of the conscious version is due to a special circumstance: Freud's assertion of the frequent occurrence even within consciousness of a similar fantasy is, to my knowledge, one of the first psychoanalytic hypotheses to have been experimentally tested (by what are called objective scientific methods) more than thirty years ago in this country and repeatedly retested since.

The relation between the individual's fantasy life and the thematic repertory of narrative art opened our eyes to two problems which interact independently. The first concerns the transition from individual fantasy to narrative account. The finding says that the fantasy of the individual, particularly the daydreams of those normal and abnormal individuals who habitually weave their reveries in continued stories, are closely related to the wish for immediate gratification, frequently derived from older, repressed, masturbatory fantasies, and have retained some of the characteristics of their origin.

Let me report to you how this problem presented itself to me in my days of apprenticeship. A twenty-year-old youth, interested in many aspects of his medical work, showed by his behavior the wish to impress his teachers as the most gifted and most effective student of a large class, in order to become the one who would, in each of the specialties in which he happened to be interested, make decisive contributions, and thus acquire in the professor a new and more powerful paternal protector. Apart from more obvious and typical dynamics, this behavior repeated the course of a "continued story" which since the age of five or six had dominated the young man's life in many variations. In this fantasy he was the son of the Crown-Prince of Austria, Rudolph, and had been placed as foster-child in a middle-class family. For years the stories which he told himself dealt with the topic of how he would gloriously come forward and rescue his country; how he would meet his grandfather, the emperor, and gain admiration from his own, real parents. This moment, when he would meet *them* was the focal point. Whenever this scene approached, a new setting had to be invented, since the fantasy would start to roll off fast and faster; then the details became unimportant, the "need" to get there dominated his thought, until the whole setting had become unusable and a new version had to be elaborated, soon to become subject to the same fate. The climax had swallowed the plot.

The story teller, professional or amateur, has liberated himself from similar urgency, can dispose and distribute where the daydreamer is subject to pressures since he cannot delay gratification. Here we have a first and basic precondition to the socialization of what previously was a private experience.

The second problem which impressed psychoanalysts early in their work concerns a finding first established by analytic observation and since corroborated in the study of child behavior. What narrative art offers to the child tends to be treated unconsciously as if it were a fantasy and appears in dreams as its substitute. But a borrowed fantasy can be less guiltily used since it comes from outside. The quest for such external stimulation, the need to "borrow" fantasies instead of elaborating one's own tends to grow under the pressure of certain typical conflicts, particularly those of the phallic phase of psychosexual development.

Amongst the accounts which stimulate the child's fantasy-life a special place is reserved for those which early in their development the

parents or significant substitutes tell or read to their children; these are the stories which tend to remain imbued with the memory of a specific shared experience and to be assimilated with particular ease.

Taking this as an example, we may generalize on the function of the narrator in society. He is the one who under given circumstances, in any specific cultural environment, fulfills a need of his audience. In primitive society it is the bard's prerogative to speak of the unspeakable, of incest, parricide and matricide, of the gods and the demons. However much has changed, some such prerogatives still remain peculiar to the professional narrator. We ascribe to him the faculty of adapting what he knows from personal experience, from his own fantasy, to the needs of a community. We do not necessarily assume that what he tells is a tale all his own or all about himself. His faculty includes the capacity to assimilate many patterns of conflict, to react to minimal experiences with emphatic understanding. In speaking of thematic generalization, I have this set of faculties in mind.

Amongst the narrator's public there are those who have remained on the level which we have discussed: they follow the quest for fantasies which they can borrow. And yet, this is quite obviously only one of the possible attitudes to narrative art.

To meet the demands of a public may mean a variety of things and neglects differences as fundamental as those between the Broadway hit or the pulp magazine and the great work of literature, differences which can, in some instances, be established by common sense, but which in other instances become subject to the verdict of the literary critic whose function I am not prone to underrate. It is to him that we as psychoanalysts hope to supply some tools. The two contributions of psychoanalysis to the study of creative imagination, to which we now turn may be said to serve this purpose.

The consideration of the *emotive* or *esthetic potential* is derived from the study of dreams. The texture of dreams, woven out of the day's unfinished thought and repressed and reawakened impulses, presents us with an imagery that is only in rare instances of "meaning" to the dreamer. Only the psychoanalytic method enables us to understand it.

The overdetermination of single elements in the dream or of whole parts, the condensation of many thoughts into one element or the representation of one thought in various disguises, these and similar

mechanisms are an intimate part of the "dream work," which produces the manifest dream content. The study of the mechanisms of the dream have suggested that similar mechanisms play a part in the working of creative imagination, in the production of the work of art. But it is a similarity particularly important for its clear differences.

The language of the dream which is in force when we are asleep, becomes a tool of the creator. The trance or reverie in which it emerges has the capability of most efficient communication. What in the dream impresses us as *overdetermination* becomes the *potential* of the art work. This principle has been applied to the study of various media. It is by no means limited to the understanding of narrative creations, and it contributes decisively to our understanding of especially the great masterpieces. The Oedipal conflict in Hamlet or in the Brothers Karamazov is not represented in one but in several versions. There is no one theme that has not its variations; in the relation of several sons to their fathers the central conflict is treated in various interconnected aspects in both these works. Without an understanding of the interaction of those thematic variations, or of the de-composition of one central figure into various characters, of one conflict into its various components, even the most elementary approach to the great thematic compositions cannot be attempted. Such variation of one theme may coexist with the condensation of various different themes into one incident and finally with the condensation of various meanings into one account. When Shakespeare scholars point to the meaning of *Hamlet* in terms of the contemporary Elizabethan scene, this does not contradict other interpretations: contemporary and mythological themes are interwoven. The public is faced with a multiplicity of meanings, integrated into one work and supporting each other.*

The similarity of artwork and dreamwork has been best explored and demonstrated in the study of poetry; particularly by William Empson, whose critical writings have been fertilized by psychoanalysis. Poetry is "filled with meaning" more than any other type of verbal communication; words are stimuli to associations which lead in various directions, and when Mr. Eliot, as critic, wishes to appraise the work of one of his contemporaries, of, let us say, Miss Moore, we find him saying that her poems have "a very good spread of associations." Mr.

* It is not implied that this approach "exhausts" the meaning of the art work, whose structure, naturally, may be, and frequently is infinitely richer.

Eliot should know, since the extraordinary richness of his own "spread of associations" seems to have given to his work his unique position in the poetry of this age.

Let me resume: The multiple meaning constitutes richness; the dichotomy between appropriate ambiguity and hidden precision, the latter more stringent as the lines flow into the stanza, becomes an important criterion in the study of poetic language. There are poets who are masters of multidimensional vagueness, without leading finally into the growing precision; there are others, whose lines differ from ordinary verbal communication only by meter, rhythm and setting, by the "music of poetry"—but do hardly use the very complexity of meaning. All this seems to have become more understandable to us through our experience with contemporary poetry: here complexity of words tends to be maximized, multiple meanings abound, and uncertainty of interpretation tends to prevail. There can be little doubt that in this the modern poet is more than accidentally akin to the dreamer; also the phenomenon is not limited to any one artistic medium. It is one of the distinguishing features of much that appears in modern painting. It reveals, I believe, in part the influence of psychoanalysis on modern thought. Not of psychoanalysis as a science, but of some of its findings acting as a social force: there is a trend in modern art to consider the work of art as a documentation of the creative process itself, a tendency which expresses itself in a shift in the traditional or previously existing relation between the artist and his public.

This then brings us to a third area of problems upon which psychoanalysis has thrown light: I propose to refer to it in speaking of "*Creative Communication.*" Psychoanalytic insight has helped to clarify some of the experiences which creators in many fields have described as long as a tradition of introspective writing has existed in Western civilization. These reports can be briefly summarized in the following terms: Creation tends to be experienced as a dichronous process; it has two phases which may interact with each other in various ways. They may vary in duration, frequency of occurrence, and intensity. In the first the creator is driven; he is in an exceptional state. Thoughts or images tend to flow, things appear in his mind of which he never seemed to have known.

I quote: "A thought suddenly flashes up like lightning: it comes with necessity. I have never had any choice in the matter. . . . There is

the feeling that one is utterly out of hand, with the very distinct consciousness of an endless number of fine thrills and titillations descending to one's very toes. There is a depth of happiness in which the most painful and gloomy parts do not act as antitheses to the rest, but are produced and required as necessary shades of color in such an overflow of light." The sudden character of the experience described in this quotation from Nietzsche's *Ecce Homo* stands in contrast to the second phase of productivity, when all is labor, when the creator looks upon his work, as it were, from the outside, and concentration and endeavor predominate. No one in recent decades has more sharply contrasted these two phases than A. E. Housman, to whom we not only owe one of the most vivid descriptions of creative inspiration, but also of the "hell that is to pay" when the flow has tarried. As the manuscripts of his poems became accessible for study—some of them in the Library of Buffalo University, where documents on the process of creation are being collected—we can watch the difference which he describes, the instances when lines or a stanza flew to the mind, and the others, when ease was absent and purposeful concentration had to substitute.

Psychoanalytic observation of creative individuals leads to a somewhat better understanding of such descriptions. In the state of inspiration the psychic apparatus is in an exceptional condition. The barrier between the Id and the Ego has temporarily become permeable. Impulses reach preconsciousness more easily than under other conditions, and their translation into formed expression can proceed painlessly. Forces previously used for repression are being used by the Ego for another purpose. All energy seems to be vested into the process of coming to consciousness; hence the similarity between inspirational experiences and those of a hallucinatory kind, a similarity once more clearest in its difference.

The coming to consciousness in the case of creative effort presupposes a long unnoticed process of shaping: it is this process which, entrusted to preconsciousness, is geared to integration and communication. But the process of creation is not completed during its sudden and inspirational phase.

When the first phase gives way to a second, when the artist steps back to view his work, one might say he identifies with his public; he views what "the spirit" has done. He views it, temporarily, from the outside.

The reaction of the public repeats in reversed order and in infinite variations some of the processes which the artist experienced. These variations are determined by cultural and social factors as well as by individual predispositions. Though these reactions may vary in depth, the core of the process, a gradual moving from the fringe to the center, seems to occur with great frequency. It is impeded when we read the narration as if it were a daydream to be borrowed, or when the art work becomes the pin-up girl, i.e., when we miss the distance from immediate gratification; then we are taken back to more primitive modes of reactions. Clinical observations of such incomplete reactions to the creative effort constitute a promising field of investigation in their own right. It is not of these failures that I intend to speak, but of the successful reaction: then the process from the fringe to the center means that gradually a change in the attitude of the audience is taking place.

This change may have various dimensions. It may lead from the borrowed fantasy stage to the appreciation of the complexity of thematic composition, from *what* is being said to how it is being said, and here again from the pleasure in rhythm to a gradual understanding of first one, then many interacting and integrated meanings. These changes have one factor in common. They are all changes involving the movement of the audience from passivity to activity. In the end the audience may experience some of the excitement and some of the release of tension which arises when the barriers separating unconscious from preconscious or conscious processes have been loosened: "Next to the seizures and shapings of creative thought—the thing itself—no comparable experience is more thrilling than being witched, illumined and transfigured by the magic of another's art." (H. A. Murray)

In speaking here of re-creation we stress that the shift in psychic levels which operated in the creative process is repeated, and that in this sense the public identifies itself with the artist. The process of identification to which we refer does not concern the artist as an empirical individual.

How could we assume that biographical familiarity should be essential when the greatest artist's personal life is shed in anonymity? And yet, no other compares to Shakespeare as master of creative communication. The identification with the artist's biographical person may be the conscious business of the critic, and re-creation at this point may become reconstruction, the reaction of the connoisseur. What we, here,

mean by identification with the artist is an unconscious process in which the audience becomes in its own right creative by being re-creative. It follows the spell of the emotive potential. The understanding then leads to the unconscious mechanisms which the artist had used, to the impulses he had mastered; the audience is with him both in reaching downward and in mastery. We do not assume that the audience's experience need be or can be identical with that of the poet. "A poem" says Mr. Eliot, "may appear to mean very different things to different readers and all these may be different from what the author thought." The readers' reaction may be richer in implication than the creator ever supposed. There is that old word, the core of all psychology of the great, which says: "The genius builds better than he knows."

At this point the psychoanalytic approach may turn out to be useful to the critic in a new sense. It is conceivable that some of the attributes which lend artistic value could be measured by the study of response, and, more particularly, by the survival of great art works as effective stimuli. The study of their emotive or esthetic potential may account for the lasting appreciation of such unique formulations as that of Sophocles in his Oedipus Trilogy, or for many comparable achievements in the arts which seem to triumph over changes in social affairs. Many generations of men repeat what seems to be the fundamental reaction to creative imagination in art: they accept the invitation to an experience of the mind in which a specific and particularly intensive kind of intrapsychic communication is temporarily established, in which controlled regression becomes pleasurable since the experience stands under the firm and unabated control of the Ego, which has reasserted its functions: it has become creative, or re-creative.

This outline of some of the problems which occur in creative communication cannot be terminated without, however, a brief mention of two of the sources of insight which have proved particularly valuable. One large field of study which has attracted the attention of many investigators concerns the specific function of creative processes in the therapeutic situation: the creative communication is then limited to the creator and the therapist. Story, poem, or picture facilitate the "coming to consciousness"; the creative experience becomes part of the therapeutic procedure. Whatever the limitations of this technique, even its disadvantages, it has proved, with certain individuals, to be of considerable value. If we try to generalize the conditions under which this is the

case, we may say that when free association itself is too threatening, when it might lead to a regressive rush which can no longer be controlled, channelized into production and shaped by the Ego, the onslaught of the repressed can still be organized.

This experience has sharpened our eyes to similar processes outside of treatment situations, in which psychological balance is being reestablished by creative activity. When in the course of a particularly intensive conflict, narcissistic regression threatens the creative act, an attempt to communicate with others and to establish contact may act as a catalyst. The very intensity of conflict may lend particular impact to the work thus created. This is true of some of the productions of later psychotics produced during the pre-psychotic phase of their illness. A normal counterpart to the extraordinary richness and sometimes deceptive fascination of their productions may be found in the expressive ventures of some adolescents who solve the age-specific intensification of their conflicts by sudden and frequently transitory spurts of creative activity.

The second area of clinical experience in which the study of creative communication has become particularly fruitful concerns the artistic productions of the insane; here the variety of meanings which the process of creation gains for the individual becomes apparent; words are not signs but acts, pictures tend to become verdicts, and creation may mean "making" in a literal and magical sense. In extreme cases the artist identifies himself with God, the creator; he destroys and restores, rules and organizes in creating. The delusion of the psychotic artist has its counterpart in the unconscious fantasy of many creative individuals and determines some of the complex attitudes of the artist toward his work; foremost among these, the striving for perfection and the feeling of responsibility in exercising his power as creator. What appears as diffusion of instinctual drives, as magic destruction and reparation in the work of the psychotic, plays its part in many creative processes, but the regression to magical procedure is only partial and temporary. This difference becomes clearest when we realize that the product of the psychotic is created as an act to influence the course of events, while the work of the non-psychotic plays upon an audience from which it aims to elicit responses.

The value of the study of psychotic art for a deepening of our understanding of creative processes in general should not lead us to

underestimate differences, a tendency particularly significant in the contemporary scene. The interest of certain artists and of sections of the public in productions of the psychotic has suggested to some a comparison between modern and "psychotic" art, a comparison which points to similarities as evidence of disintegration in our civilization, or of "cultural psychosis." I feel unable to share in, or even to discuss in detail, speculations leading in this direction and find it more useful to refer to what has been briefly suggested before. The fact that productions by psychotic creators have gained esthetic significance for part of the contemporary public is, I believe, due to the fact that their extreme and often badly integrated ambiguity is experienced as a challenge. "Psychotic art" serves as a screen for a generation to which the exercise of projective power has become to some extent pleasurable in itself. We have spoken of the influence of psychoanalysis on the artists. We have now to add that such influence naturally includes the reaction of the public. The preference for forms which stimulate projection, which enhance the creative activity of the public is not unique in history. Although it seems that it has never been as consistently pursued as during the last decades, it has occurred with varying intensity during various historical periods. Psychoanalysis can only point to the existence of a psychic mechanism, which manifests itself as a partial shift of roles in creative communication. The importance of this shift during various historical periods may be established in studies by experts in cultural change to whom psychoanalysis may have here suggested a new perspective.

The three problem areas which have been reviewed represent only a selection of what psychoanalysis has contributed to the study of creative imagination. Let me now for a moment speak not of what was achieved but of that which we would most like to know; not of results but of questions. All that concerns the typical predispositions of the masters of creative imagination, if such a "typical predisposition" exists, all that concerns the ontogenetic approach to the creator, remains in darkness.

Who are those best equipped for creative work, those whose creative imagination functions with greatest ease and most appropriately? Needless to say that no answer can be offered; we have not been able to solve a problem which during the ages has puzzled all and has evaded even speculative approaches; and we remember Freud's modesty when

dealing with it.

When as psychoanalysts we study the artist's personality we are subject to the limitations imposed by the therapeutic situation. Hence most of the statements of psychoanalysts seem to focus on relevant but not on specific factors. There is the impression that in the early history of creative individuals traumatization may play an unusually great part; there is some evidence that there are definite peculiarities in the function of certain defense mechanisms—a problem to which Freud referred when he spoke of "the flexibility of repression" in the artist, which he shares with many severely impaired individuals. With some of them the creative individual is said to share the proclivity to a passive attitude manifest in the high incidence of homosexuality. But again it is the difference which seems most suggestive; the passive abandonment is the matrix of the artist's inspirational experience. Let us at this point turn to speculation: the biological nature of man, one might say, accounts for the fact, that on the verge of his greatest and supremely active effort, in creation, his experience tends to be mixed with passive elements; he receives from outside, what he is to elicit, he incorporates before he produces and experiences even his own thought as reaching him as benevolently tendered from an outside agent.

The quest for the specific confronts us with insight into the limitations of our knowledge. All that we can attempt is to point to certain trends in current research which seem to lead in a definite direction.

When we speak of talent and gift we assume the interaction of inborn endowment and environmental influences. For some decades the first area had been neglected; during the last few years it has resumed some of its importance and gradually more and more investigators in various fields turn in this direction. The psychoanalyst expects most of the attempts to study the endowment of the human infant in his earliest stages, to watch how it is molded by the mother and how the mother responds to what appears to be the specific individuality of the newborn. Only in long and painful study may such observations lead into the area where the development of properties in any sense akin to gift and talent may become observable.

Observation here as elsewhere may well follow the path outlined by the clinical impressions gained in psychoanalysis. Let me illustrate this by some examples: The influence of early traumatic experiences on creative activity, their reflection in the artist's work has been men-

tioned. In approaching the study of the child's first forming activities in the development of his fantasy life the reaction to and impact of threatening experiences becomes equally apparent. Imagination tries to cope with threats; fantasy arises in part as a defense against danger. Clinical observation in psychoanalysis has pointed to the role which the interplay of libidinous and destructive impulses plays in the artist's work. Observation of children in their creative activities confirms these impressions. Two-to-four-year olds studied in their behavior at the easel, playing with paint, building blocks, give us a picture of the dynamics of the creative process, more dramatic and richer in detail than expected. There is the child who tentatively approaches the easel, who gingerly puts down line after line, color neatly next to color; then colors are mixed, movements become more rapid, excitement grows, immediate discharge rules. The child has followed the seduction which brush and colors have exercised. Over the months that temptation is gradually mastered. With order, even meaning may accrue to the painting; the impulses to smear may return at times of pressure, and yet the distinction emerges between a completed work, and one which is not completed—whatever completion may mean to the child. The child learns to resist the temptation to destroy what he has just produced, and the functions of expression and communication come to the fore. Such observations are far from the realm of art; they describe what, with a term which has grown somewhat loose, we mean by sublimation. But observations of this kind are part of the empirical study of the development of creative behavior as part and parcel of the development of personality. (I may use this opportunity to report that a psychoanalytically based study of creative imagination is being supported by a grant of the Arthur Davison Ficke Foundation to the Medical School and the Child Study Center of Yale University.)

In one fundamental respect these directions of research and the first tentative impressions seem to prove that recent progress in psychoanalytic theory may help to clarify even complex problems. At the outset I stated that the influence of psychoanalysis upon science and social organization as well as its unique place in medicine was initiated by the scientific study of conflict. But human faculties emerge from conflict. The peeping Tom becomes painter or scientist; children who wildly and excitedly brush colors on paper may develop highly differentiated skills; their painting activity may successfully emerge from

conflict and may develop into a special aptitude. Such detachment of activity from conflict, its fundamental autonomy, is facilitated by certain types of endowment, facilitated further by an infinite range of possible life experience and their interaction.

If we look from the battle for creation in the child, back to the clinical data which psychoanalytic investigation reveals, i.e., to the battle of creation observable in some analytic patients, a certain affinity becomes apparent. *It seems that in every process of creation the gradual emergence from conflict plays its part.* It may start out in serving a fantasy of the individual, in meeting an individual's needs, but to the extent that it emerges from conflict, certain properties may be acquired which are akin to, and some of them identical with gift or skill. We mentioned that themes may be generalized, the emotive potential may grow and the process of creative communication may be initiated. All that is not only the result of conflict; it is at least in part due to the integrative, and in this instance autonomous, powers of the Ego. And thus creative imagination may lead to concrete achievements; some of them art, others devoted mainly and solely to problem solving, to inventiveness in science, or simply to the enrichment of the individual's existence. At this point the problem leads back to the broad stream of our work; for next to therapy stands not only, as was said, the problem of prevention but also that of turning from the infinite variety of the mentally ill to the equally infinite and less explored variety of the healthy. The study of conflict embraces both the well and the sick, it is part of human life, and no basic science of psychopathology can avoid being at the same time basic in the psychology of normal behavior.

In what preceded I have reviewed the thoughts and contributions of many analysts. I have not mentioned names, since this is the occasion when we all join in grateful remembrance. If I have given you the impression that our curiosity is far greater than our knowledge, that we are moving under the guide of clinical experiences to tentative generalizations, I will have been able to convey to you the spirit under which psychoanalysis has developed in the work of Freud.

MONTHLY PANEL MEETING ON THERAPEUTICS FOR THE GENERAL PHYSICIAN

AT THE ACADEMY—4:30 P.M.

Final Meeting of this Series

FRIDAY, APRIL 24, 1953

Subject: RHEUMATIC FEVER AND RHEUMATOID ARTHRITIS

Moderator: Charles Ragan—Associate Professor of Medicine, College of Physicians and Surgeons, Columbia University

Members: Theodore Bayles—Clinical Associate in Medicine, Harvard Medical School
Edward E. Fischel—Associate in Medicine, College of Physicians and Surgeons, Columbia University
Joseph Lee Hollander—Assistant Professor of Clinical Medicine, University of Pennsylvania
T. Duckett Jones—Lecturer in Medicine, Harvard Medical School

EASTERN STATES HEALTH EDUCATION CONFERENCE

THURSDAY AND FRIDAY, APRIL 23 and 24, 1953

THE SOCIOLOGY OF HEALTH EDUCATION

APRIL 23—9:30 A.M. TO 4:30 P.M.

Morning Session

The Anatomy of a Community

Afternoon Session

Communal Stratification and Communication

DINNER—SUBSCRIPTION

APRIL 24—9:30 A.M. TO 4:30 P.M.

Morning Session

The Sociology of Health Education

Afternoon Session

Integrative Discussion and Resumé

REGISTRATION FEE: $10.00

Searle Research Progress Report:

Continued investigational work has resulted in Pro-Banthine, a new anticholinergic drug with high potency, small dosage, minimal side effects, agreeable taste and convenient dosage schedule.

The new anticholinergic, Pro-Banthine* (brand of propantheline bromide) provides a powerful drug in the therapy of peptic ulcer, intestinal hypermotility and other conditions of parasympathotonia.

The high potency of Pro-Banthine permits its use in small dosage. With the suggested dosage of one tablet (15 mg.) with meals and two at bedtime there is little likelihood of untoward manifestations.

Pro-Banthine has a pronounced inhibiting action on stimuli at (a) the parasympathetic and sympathetic ganglia and (b) the effector organs of the parasympathetic system.

Pro-Banthine is produced for oral use in 15 mg. sugar-coated tablets.

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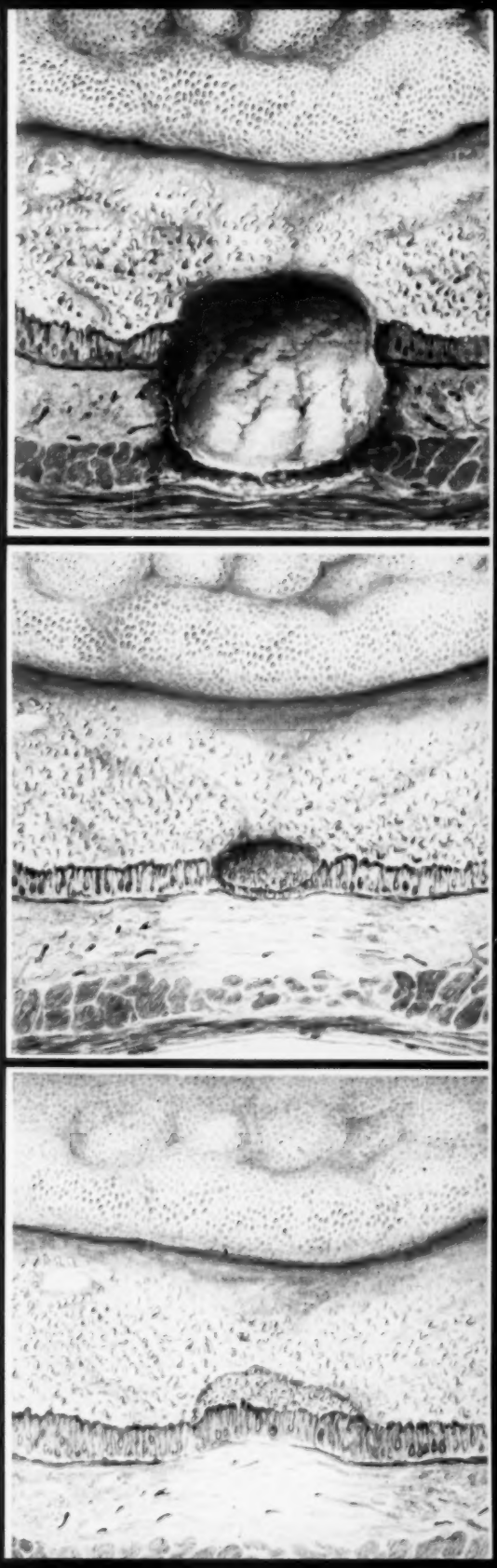
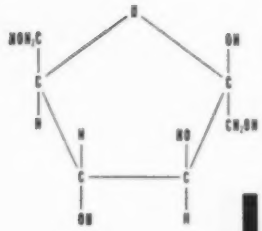


Top—Section through duodenal bulb just distal to pylorus through center of ulcer crater.

Center—Healing ulcer with scar tissue and regeneration of tissue layers.

Bottom—Healed ulcer with restoration of mucosa.



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- Less loss of calories through glycosuria
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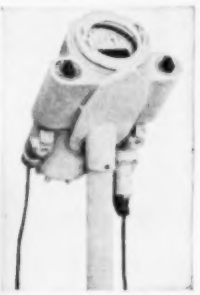

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The first Cambridge Electrocardiographs were made available to the medical profession over thirty-five years ago. It is fortunate that from the beginning, these instruments produced consistently accurate electrocardiograms, since it was upon these records that the science of Electrocardiography has been largely built in this country. It follows, therefore, that the Medical Profession looks to CAMBRIDGE for new instruments now demanded in the tremendous development the science is undergoing.

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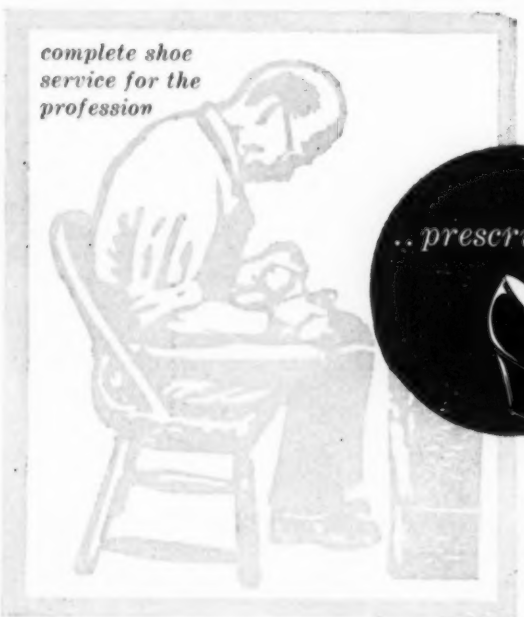

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1. Behrman, H. T., Combes, F. C., Bobroff, A., Leviticus, R.: Ind. Med. & Surg. 18:512, 1949.
2. Turell, R.: New York St. J. M. 50:2282, 1950.
3. Heimer, C. B., Grayzel, H. G., and Kramer, B.: Archives Pediat. 68:382, 1951.

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April 2

TREATMENT OF DIABETIC KETOSIS AND COMA
Edward Tolstoi, *Associate Professor of Clinical Medicine, Cornell University Medical College.*

THE MANAGEMENT OF THE ENLARGED OVARY
M. A. Goldberger, *Attending Gynecologist to The Mount Sinai Hospital.*

April 9

THE MEDICAL MANAGEMENT OF ACUTE AND CHRONIC ARTERIAL OCCLUSION
A. Wilbur Duryee, *Professor of Clinical Medicine, New York University Post-Graduate Medical School.*

SKIN CANCER
Anthony C. Cipollaro, *Professor and Director, Department of Dermatology, New York Polyclinic Medical School and Hospital.*

April 16

HALSTED, MAN AND SURGEON
Bertram M. Bernheim, *Associate Professor of Surgery, The Johns Hopkins Medical School.*

WILLIAM H. HALSTED; THE SURGEON'S PRECEPTOR
John J. Moorhead, *Professor Emeritus of Surgery, New York University Post-Graduate Medical School.*

CANCER OF THE BREAST
William C. White, *Clinical Professor of Surgery, Columbia University, College of Physicians and Surgeons.*

April 23

METABOLIC EFFECTS OF INSULIN
DeWitt Stetten, Jr., *Chief, Division of Nutrition and Physiology, The Public Health Research Institute of the City of New York.*

PRECANCEROUS LESIONS OF THE VULVA
Mortimer D. Speiser, *Associate Clinical Professor of Obstetrics and Gynecology, New York University Medical College.*

April 30

PAUL EHRLICH, MAN AND SCIENTIST
Selman A. Waksman, *Professor of Microbiology, Rutgers University, New Brunswick, N. J.*

PAUL EHRLICH AND MODERN CHEMOTHERAPY
Perrin H. Long, *Professor of Medicine and Chairman of the Department of Medicine, College of Medicine, State University Medical Center at N.Y.C.*

USE OF HORMONES IN THE PALLIATIVE TREATMENT OF MAMMARY CARCINOMA
George C. Escher, *Assistant, Memorial Hospital, Section Head, Hormone Chemotherapy.*

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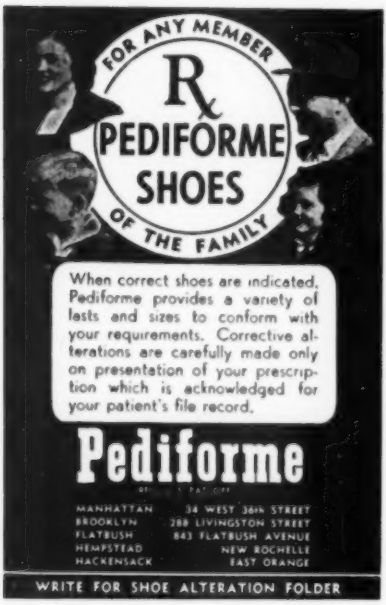
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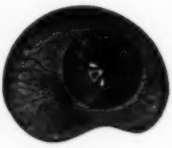

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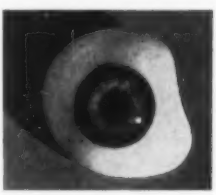

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1. Meller, R. L., and Resch, J. A.: *Bull. Univ. Minnesota Hosp.*, 20:78, Oct. 8, 1948.
2. Meller, R. L., and Resch, J. A.: *Postgrad. Med.*, 6:452, Dec., 1949.

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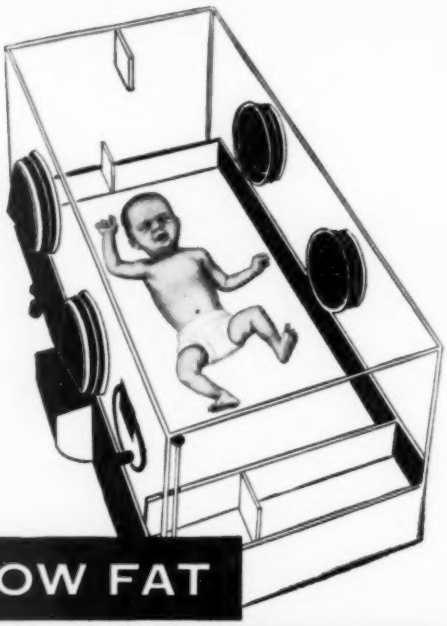

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*Gordon, H. H.: Feeding of Premature Infants, Am. J. Dis. Child. June 1947.

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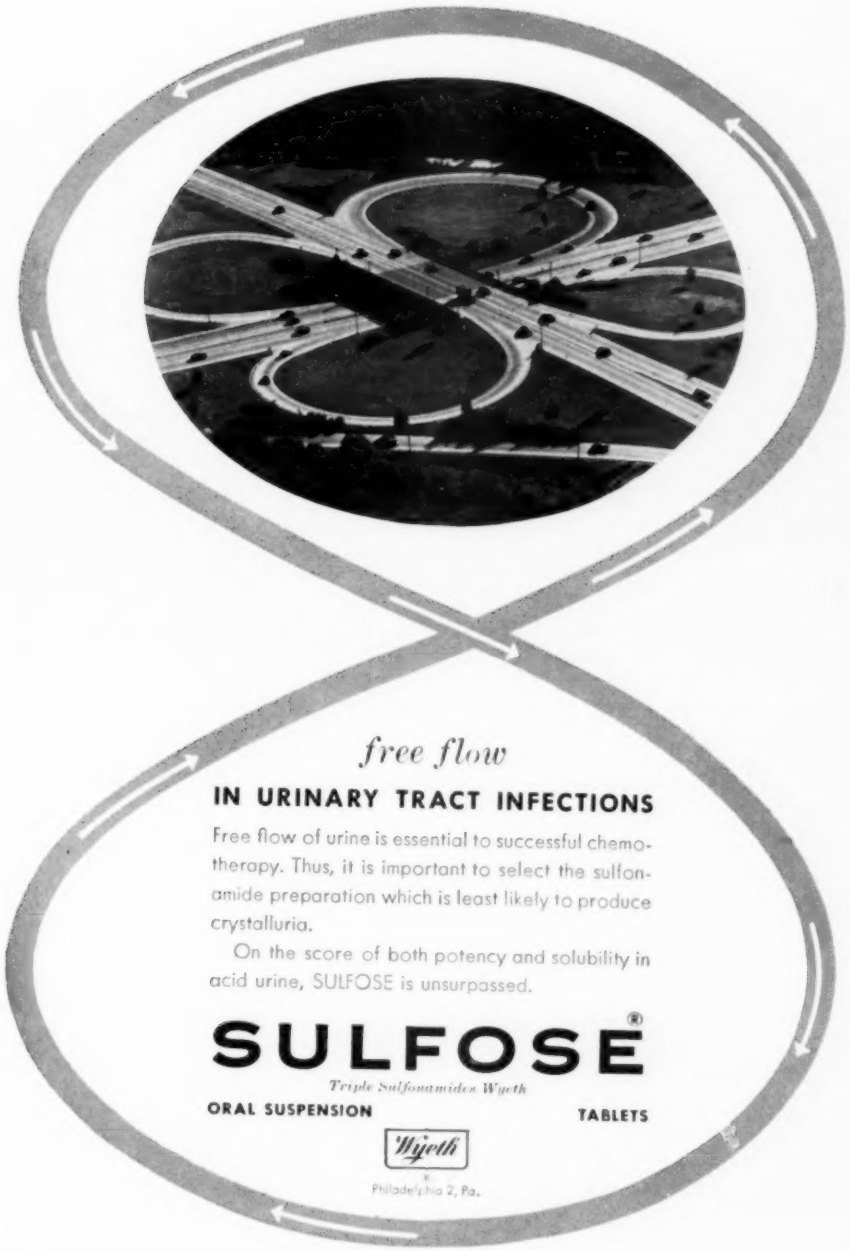

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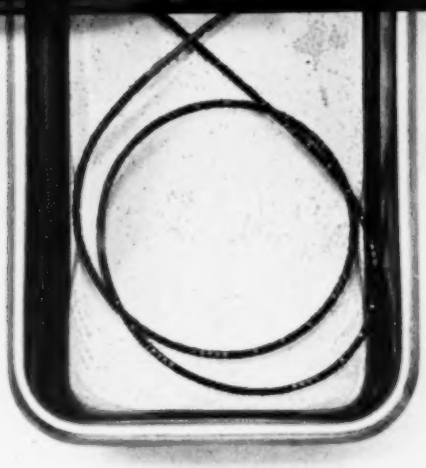

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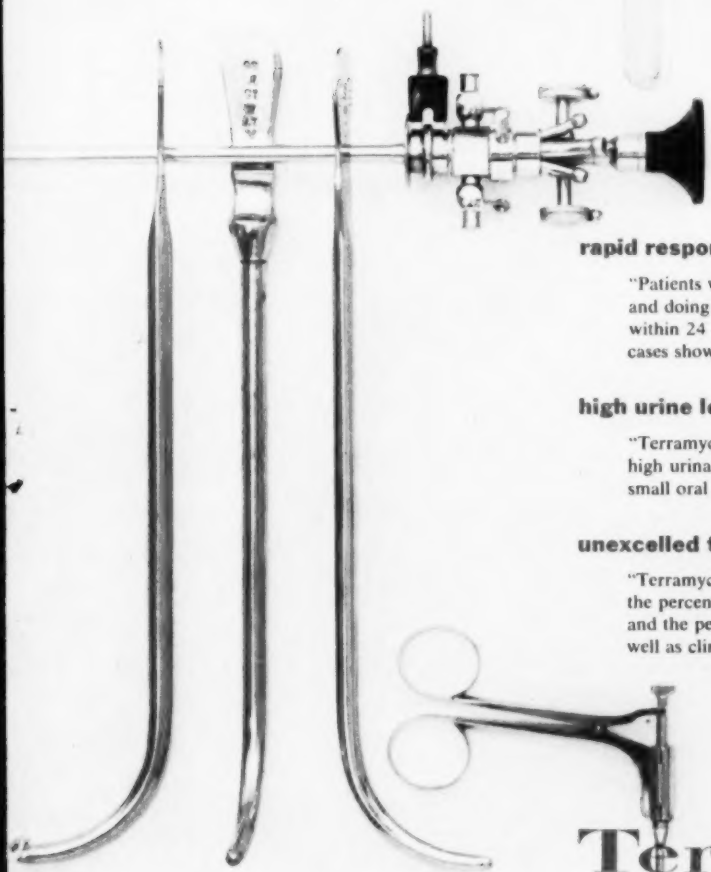

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1. Canad. M. A. J. 66:151 (Feb.) 1952.
2. J. Urol. 67:762 (May) 1952.
3. Ibid. 69:315 (Feb.) 1953.

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1. Moyer, J. H., and Handley, C. A.: Federation Proc. *11*:378, 1952.
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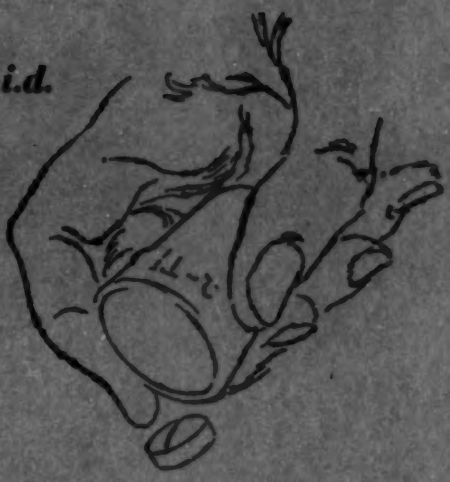

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